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# **Identification of Key Resource Streams in Commercial & Industrial Waste from Small Businesses in the Food Sector**

## **Part 1: Main Report**

*April 2007*

*Christine Thomas, Paul Dacombe,  
Angela Maycox, Charles Banks, Talat  
Khan and Rachel Slater*

*The Open University and  
University of Southampton*

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Views expressed in this report are those of the authors and not necessarily those of The Open University, Southampton University, or the funding bodies.

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## ***Executive Summary***

### **Project design and context:**

This research, carried out by University of Southampton and The Open University's Integrated Waste Systems research group, has been funded by The Veolia Environmental Trust through the Landfill Tax Credit Scheme and through the EPSRC's Sustainable Urban Environment (SUE) programme. Additional support has been given by Hampshire County Council and South East England Development Agency (SEEDA).

The key objectives were:

- to develop a robust methodology for auditing commercial and industrial (C&I) wastes from small and medium sized enterprises (SMEs);
- to test the methodology and the performance of the questionnaire both in terms of usability and the level of detail obtained in assessing waste arisings from these businesses; and
- to carry out a survey in Hampshire of the food sector SMEs to identify resources available in this waste stream.

The project aimed to provide a framework in which business, local authorities and the waste management industry can work to optimise the recovery and re-use of key resource streams. By correlating the findings with household waste data in Hampshire it offers opportunities for further exploring combined recovery and the potential gain from a comprehensive integrated approach to management of municipal and C&I wastes.

Government figures estimate the amount of commercial and industrial (C&I) waste generated in England in 2002/3 was just under 70 million tonnes, between 2.5 and 3 times the amount of household waste produced in the same year (Defra, 2006). Although the former has an overall higher record for recycling and recovery at 45% in 2002/3, the material disposed of still represents a considerable untapped resource. Food manufacturing, retail and wholesale and the hospitality (hotel and catering) sectors together account for about 34% of all C&I waste. The Environment Agency 2002/3 survey (EA, 2005) concludes that around half of the total C&I waste in England and Wales is produced by SMEs, with nearly 70% of commercial waste attributable to SMEs. SMEs are usually defined as businesses employing less than 250 people; with medium enterprises having 50-249 employees, small enterprises 10-49 employees and micro businesses 1-9 employees.

Recently the agenda has begun to focus more on improving the resource efficiency and management of waste from the commercial and industrial sector, and in particular from SMEs – the least understood sector in terms of wastes produced, its composition and potential for minimisation, greater recovery and recycling. Surprisingly little research has been carried out to obtain accurate information on the quantities, nature and distribution of these wastes. Even less has been done towards development of an infrastructure through which the natural resources present within them can be recovered. Any initiative to increase recovery and recycling of resources from C&I waste needs good reliable data on the amounts and composition of those waste streams. This research programme was designed as a step towards providing that data through the development of an effective methodology for gathering statistically reliable data on C&I wastes, in particular those produced by smaller companies and sub-units of larger organisations.

## **Methodology for auditing C&I wastes from SMEs:**

In developing the methodology, the approach chosen was based on the development of a computer-based interactive waste auditing tool ('smart questionnaire') which facilitates interrogation of a series of embedded databases to provide appropriate option selection and minimise false entries. The smart questionnaire, called 'wasteQUEST', is constructed using an expert-system approach with both rule-based and hierarchical programming. It uses a simple tiered questioning approach which adapts the questions asked according to the user's responses, thus avoiding irrelevant and confusing information.

Problems such as the units in which waste is quantified are overcome by using internal conversion factors, thus allowing the respondent to specify quantities in terms with which he/she is familiar. A variety of techniques including photos, prompts, selective lists and pop-up information boxes are used to obtain more accurate information on waste generation. These are employed throughout to assist the interviewee and speed up the questioning process.

There are six main areas interrogated by the questionnaire: business details, waste routes and disposal methods used by the business, the containers used, the types and amounts of waste generated by the business, occasional wastes produced and waste awareness.

Information about the amounts and types of waste produced by the business is gathered through a variety of approaches to build a picture of total waste arisings. These include questions asking about:

- wastes that arise on a regular basis and those that occur only occasionally such as due to maintenance work;
- containers used to store wastes prior to their collection for disposal or recycling;
- routes by which waste leave their premises, including main waste recycling or disposal contractors (whether private companies or local authority) as well as other routes that may include taking the wastes to a HWRC (household waste recycling centre) or taken back to a central depot;
- frequency that waste is collected or taken away;
- container fullness;
- what materials types are disposed of by the business, from detailed resource lists;
- estimates of how much of each type of material goes into each container.

A key aspect of the research was in identifying the potential for improved recovery and recycling. Hence the compositional categories used in the audit focused on identifying the key resource streams using a cascading structure based on twelve main resource streams; sub-divided into 25 main waste categories and further into 59 more specific sub-categories. The questionnaire was designed to record waste composition information at as detailed a level as available; hence if the interviewee can only provide estimates of what materials are in their waste stream at the 12 main category level then this is recorded and is sufficient to provide the tailored feedback at the end of the questionnaire. If however more detailed information is available then the questionnaire takes the interviewee to a page where they can choose more specific sub-categories of each of the main resource types.

A robust sampling strategy was developed to ensure statistical reliability. Based on the business profile for SMEs in the food and drink related sector in Hampshire a database of businesses was compiled from which the sample for the survey was drawn using quota sampling based on SIC codes and business size.

The use of in-built databases allows for direct feedback to the company to satisfy an essential criteria for engaging business participation – that of providing an incentive for taking part.

As well as comparative data on their waste audit, this might include information, based on local knowledge, of the nearest recycling facilities or outlets, and about the regulations and legislation that is relevant to the particular business being surveyed. However despite this incentive and the use of multiple channels of communication (flyers, use of networks, letters including support from the local authority, telephone contact) the overall response levels from businesses to participating in the survey was disappointingly low.

### **Potential for use of the methodology for large public institutions:**

The methodology described above was developed with SMEs specifically in mind. It does, however, have the potential to be used to carry out waste audits on other types of businesses, including large-scale institutions/public bodies such as local authorities, hospitals and universities.

Large organisations can potentially be disaggregated into a number of component parts, as they generally consists of multiple departments each carrying out different functions, and in some cases with multiple sub-units under their control. Many of these units will behave similarly to SMEs and face the same problems in effective management and disposal of their waste, with the difference that it is easier for them to seek group solutions.

Each department can then be classified according to their activity and size, in terms of number of employees. This information can then be used to build a “business profile” for the organisation, from which the auditing requirements for the organisation can be determined, using a similar approach to that described for the Hampshire food sector SME survey.

Two types of organisations are described, with a possible audit methodology for each. The first is a large local government organisation such as Hampshire County Council (HCC) where a bottom-up (i.e. individual departments/units) approach is suggested. HCC has a large number of departments/units that are essentially self-managing and located throughout Hampshire which can be considered to be similar in nature to SME businesses. A ‘business profile’ can be generated, either grouped by appropriate SIC code or type of activity, and suitable modifications can be made to the questionnaire for an audit to be carried out. From the waste audit, as with that for the food sector SMEs, an estimate of the total waste arisings for the organisation can then be made, based on the business profile.

For the second type of large organisation such as universities and hospitals – in this case Southampton University – departments/units are generally more centralised, typically mostly being located on one main campus or in one area, with satellite activities. Some may be considered as autonomous, some partly autonomous and others centrally managed, with some using shared facilities and services. This causes considerably more problems for approaching the organisation as presenting a profile of separate SME units. For this type of organisation a combination of central auditing with individual adapted questionnaires to collect data at individual unit level is needed. The results of both approaches could then be correlated to provide an overall picture of the organisation as a whole.



## **Case study survey and business responses:**

A waste audit survey of 170 businesses was carried out by face-to-face interviews using WasteQUEST. These were sampled across nine food sector business types (manufacturing, wholesale, non-specialist retail, specialist retail, hotels, guest houses, restaurants, bars and catering) and 3 size groups (micro, small and medium) from the database of over 5000 SMEs, yielding 151 usable samples. Emphasis was placed on the micro and small businesses as these are where least information is available, and whose wastes are most likely to resemble household wastes.

In terms of usability and business response, the questionnaire performed well, with no major problems arising with completing the questions. In over half of the cases it was successfully completed in the design time of 20-30 minutes, with the main reason for taking longer being interruptions caused by other business needs.

The exploratory nature of the questioning in asking about wastes in several different ways was found to be extremely useful in that many interviewees initially narrowly focused their concept of waste on one route, usually the main disposal bins that the company used. As the questioning progressed they would often remember or recognise other materials as wastes prompted by the way the questionnaire was designed. This illustrates the ability of the questionnaire design to enable more detailed information to be collected on all the wastes disposed, reused and recycled by the SMEs surveyed. This was particularly noticed in the survey for those wastes dealt with by options other than the main local authority or waste management company contractor. This 'other routes' section of the questionnaire was unique to this survey in specifically asking about these activities and beneficial in picking up extra data.

These are wastes or potential resources that might be missed by more conventional questionnaire designs. The fact that the average waste/employee or waste/business was in many cases found to be higher in this survey than values obtained in the EA 1999 national survey, suggests that not all waste and recyclable material including that sent by other routes were explicitly captured in what the businesses understood as waste in the EA survey. This is clearly indicated for the non-specialist retail group where this survey recorded significant amounts of waste recycled through 'backfill' where material was sent back to a central depot. The average waste /business without the backfill element more closely matched to the values recorded in the EA survey. This emphasis on capturing information about all wastes generated by a business enables a more accurate picture to be established of current recycling activity as well as future potential.

As part of the questionnaire the interviewee was invited to comment not only on the questionnaire but on their waste management activities, problems they had encountered, improvements they felt could be made, perceived barriers to recycling, etc. The most common issues were around costs and lack of infrastructure.

Businesses would generally only consider recycling if it proved to be either cost-neutral or cost-effective; they felt that they should not be financially penalised for recycling; and many were somewhat confused as to why they should have to pay more (or anything) to recycle their waste rather than dispose of it. It was perceived that since recycling was helping to protect the environment then they should not be expected to pay to recycle.

Local authority provision figured prominently in comments from small businesses, who generally felt that local authorities should be encouraging small businesses to recycle and should be providing facilities for them. Many of their attitudes are based around the information they receive in their other role as a householder. As householders they are

encouraged to recycle as much as possible by their local authority, which provides free facilities in order for them to carry this out. These SMEs also felt that there is too much emphasis on recycling by householders, and not enough on recycling by businesses.

Lack of facilities available to businesses was also an issue whether provided by local authorities or waste management companies, as was lack of space for appropriate facilities or for storing materials for many of the small businesses surveyed. There was also a commonly expressed need for somewhere to go for help and advice – particularly trusted independent advice.

## **Results of the food sector SME waste audit for Hampshire:**

Analysis of the survey results provided estimates of the average amounts and composition of waste produced by the different food sector business types. The food sector includes food and drink manufacturing, food and drink wholesale and retail, and hospitality businesses, including hotels, restaurants, guest houses, public houses and bars, and catering and canteens. Comparisons were drawn between business types, and the results extrapolated to give an indication of the resources in the waste stream from this sector in Hampshire.

Statistical analysis was based on waste/employee, supported by the strong correlation that was shown to exist between business sizes and waste/business; and focused on mean and 90% confidence interval values. These provided checks on the variability of the data and statistic robustness of the estimates. Results were also compared to data from the EA 1999 and 2002/3 surveys where suitable data exists, and found to be consistent with that data for both means and confidence interval data obtained. Average waste values from the Hampshire survey are consistently slightly higher than those from the EA 1999 survey, but this might be expected as the methodology of the wasteQUEST questionnaire focuses on capturing information on all potential resources in the waste stream and materials currently recycled.

The manufacturing sector was found to produce the highest waste/employee, and hence **waste per business** for SMEs in the same size band. The next highest waste producing sector is non-specialist food retail which includes supermarkets and convenience stores. Although many of these businesses are part of larger ‘chains’ and hence not strictly SMEs in ownership, in terms of waste produced per operating unit they have been included where an individual shop employs less than 250 people and hence operates at the SME scale.

The **composition of waste** produced varies between the business types as might be expected. The main components for all groups are organics (predominantly food waste) and paper & card; followed by plastics and glass. Food manufacturing has the highest proportion of organic waste per business of all the sectors (39%), as might be expected as much of its production waste would be food by-products. All of the ‘organic’ waste from this sector is food waste, of which over 90% is recycled, most of this through arrangements with other businesses. Supermarkets and general stores produce the highest proportion of paper & card at 71%, and supermarkets have the highest recycling rate for this material (81%). The hospitality sector as a whole produces the most glass, especially from pubs and bars (44%), and reasonably high proportion of ‘organic’ waste, particularly from restaurants.

Although the accuracy of compositional data collected depended much on the knowledge and understanding of the waste stream of the interviewee, the nature and depth of the questioning did provide detailed categorisation of the main resource types in the C&I waste stream from this sector. Only 6% of the waste stream was unclassified, compared with the EA 2002/3 survey where general or mixed waste were the largest overall of the 8 compositional

categories recorded, accounting for 32% of industrial waste, and 51% of commercial. A snapshot analysis sampling and weighing the waste from 24 of the surveyed companies showed a strong correlation between the composition recorded in the survey and that measured.

In comparing the different business types, **recycling** activity is highest overall in the non-specialist retail sector (61%) followed by manufacturing (55%). Recycling in the hospitality sector is low with restaurants and bars performing worst with overall recycling rates of 10% and 17% respectively. Glass was the material most likely to be recycled by this sector, with hotels recycling 64%, restaurants 19% and bars 26%. Nearly all the recycling carried out by restaurants was through their main waste disposal contractor (either a waste management company or local authority), whereas about half of the material recycled by hotels and bars was in alternative ways via 'other routes'. Just under half of the glass recycled by the hospitality sector was at recycling banks, and was even more significant for pubs and bars where this proportion was over 70%.

Waste management companies dealt with 55% of the waste; 20% was collected by local authorities; and 23% was recycled or disposed of by 'other routes'. Occasional waste, such as that from refurbishment, was recorded separately in the survey, and only accounted for 2% of total waste. Just over half of the businesses surveyed used 'other routes'; the most common of these were taking waste or recyclables to recycling banks or HWRCs, material taken by another business or backfill (i.e. material taken back to distribution depots, mostly packaging material for recycling from retail outlets). Others included recyclables given to charities and even waste taken home. Use of recycling banks was the most frequently cited other route by SMEs, but the amount of material dealt with was small in total – only about 1% of the total waste stream, even though it was more significant for glass bottles. However the fewer businesses (all supermarkets or breweries) that used backfill accounted for 16% of the total waste stream in the survey sample.

Manufacturing and non-specialist retail use other routes more than the rest of the sector; for manufacturing businesses this mostly involved arrangements with other businesses to take materials for recycling, and for non-specialist retail through use of 'backfill' or return loads to central depots. Most of this waste is recycled (92%), whereas local authorities and waste management companies recycled only 14% each of the waste they collected.

To build a picture of the resource potential of wastes from this sector for Hampshire required extrapolating the results in relation to the business profile for the county. The approach taken was to use mean waste/employee data together with national average data from the Department of Trade and Industry (DTI) on business sizes to produce estimated values for waste/business for micro, small and medium sized SMEs in each SIC code group. These were then grossed-up using the number of businesses of each type and size in Hampshire to give overall estimates of waste produced by food sector SMEs.

The survey estimated the total waste arisings for food sector (manufacturing, wholesale and retail and the hospitality) SMEs for Hampshire at just over 465,000 tonnes per year. This and the following related estimates need to be considered in context of the 90% confidence interval range for the mean values obtained in the survey data for each of the SIC code groups, since the results obtained had a relatively high degree of variability. Using this data, it is estimated that the range of values that the total waste from food sector SMEs in Hampshire is likely to be is +/- 30%, or between 330,000 and 600,000 tonnes pa.

Non-specialist retail (supermarkets and convenience stores) were estimated to produce the greatest quantity of waste, with most arising from small and medium sized businesses.

Restaurants and bars also produce significant quantities of waste with most produced by the micro and small businesses which account for 98% of the businesses in these sectors. The overall contribution from micro and small businesses with fewer than 50 employees (which account for 95% of food-related businesses in Hampshire) was 61% of the total waste. The relatively small number of medium sized companies was responsible for 39% of the total waste arisings. The average recycling activity found amongst medium sized businesses surveyed was often more than double that on average found amongst the micro or small businesses.

Paper and card are the most sizeable resource element at nearly half the waste stream (48%); 'organic' waste, predominantly food waste, is the next largest at 17%, followed by glass and plastics at 13%. The organic fraction of waste was found to be predominantly food waste – overall 94%, with the rest being other organics such as parks and garden waste and soils. The food waste fraction is mainly biodegradable kitchen/catering food waste split fairly evenly between that not containing meat as that which does contain meat; and the remainder animal or vegetable oils.

The resource potential from the waste stream of SMEs in the food manufacturing, wholesale and retail and hospitality sectors is clearly significant. The survey in Hampshire found that only 38% was currently recycled, of which just over 70% is paper and cardboard, with the rest split fairly equally between glass, 'organics' (food and plant material) and plastic, plus a small amount of wood. This indicates considerable opportunity for increasing recovery of the main material constituents, particularly paper and card, food waste, plastic and glass.

Most of the paper and card waste produced is either board or card packaging material and has the highest estimated recycling rate amongst the main resources in the waste stream at 56%. Across the sector as a whole 81% of the organic waste produced is disposed of; and of that recycled the majority is food waste not containing meat; with most of the rest being vegetable oils. Of the organic waste not currently recycled 93% is food waste but around half of this is food waste containing meat or animal oils/fats.

The survey shows similarities in the resources available for greater recovery from small businesses and those in the municipal solid waste (MSW) stream. The estimated total waste from food sector SMEs in Hampshire is just over half the amount of household waste collected in the county.

Across the County current recycling activity is dominated by paper and card for both household and SME wastes, followed by garden green wastes collected from households in Hampshire. The only material where greater quantities are recycled from food sector SMEs than for household wastes are plastics. Paper and cardboard, glass and plastics, much of it packaging materials, and food waste are all materials where there are significant amounts of both household and SME food sector wastes currently disposed of and which consequently may offer a potential in both sectors for additional recycling activity and for combined collection and/or processing.

This is not to imply that all the material currently disposed of could be recycled – far from it as much will be contaminated or prove impractical to separate effectively – however it does show where resources are concentrated. In addition what potential exists for co-collection or processing will depend though not only on this potential but also a range of logistical, operational and financial factors. The resources which appear to offer most potential from this analysis for a combined approach to recycling for wastes from households and smaller businesses are food waste, paper & card, glass and plastics.

## **Next steps:**

Comments from many of the small businesses participating in the survey indicate a willingness to recycle but frustration with lack of suitable facilities; and that more provision from local authorities would be welcomed by them. Some local authorities are pioneering the way through initiatives such as the development of the Material Resources Strategy in Hampshire (HCC, 2005). The waste strategy review in England refers to potential benefits from improving linkages across different waste streams as one way to improve the access of affordable recycling and recovery services for smaller businesses (Defra, 2006) and has now clearly placed this issue on the agenda. The results of this research project offer some information to help take this forward and assist the development of infrastructure for increased recycling from this sector, as well as opportunities for exploring combined collection and processing with household wastes.

These results however, although demonstrating the potential of the methodology, are based on a relatively small survey sample and for a limited range of business types. The food sector SMEs surveyed only account for about 13% of all SMEs in Hampshire. In order to fully explore the potential for increasing resource recovery from the SME sector further research is needed to improve data on waste arisings and composition for other SIC code groups, as well as larger surveys of the food sector to improve statistical accuracy of the results. Additional research might also focus specifically on different waste streams, such as SME food wastes for example, to explore the most resource efficient or sustainable options for dealing with these wastes. Not only is data lacking on what the resource potential is, but more analysis is needed to understand how these materials might best be captured and treated, such as whether by separate collections or recovery from mixed wastes.

The methodology was designed to demonstrate the approach and the potential for wider applicability. A follow-on stage of this research was funded by Defra as part of the Waste and Resources R&D Programme to develop the existing 'smart questionnaire' into a web-based tool with potential for assessing the wastes from any SME business type (Thomas et al, 2006). This tool has been designed to be adapted for use in other areas/regions by agencies requiring information on SME wastes, including local or regional authorities, the EA or other bodies.

The approach to auditing wastes from SMEs developed in this project has proved able to provide reasonably detailed data on the resource potential of SME wastes. In addition, in future developments, this data could be used to generate a resource map of C&I waste resources which could be used in planning infrastructure needs, in identifying opportunities for new businesses to develop using the resources reclaimed from waste, and in mapping the way forward for the sustainable management of C&I waste in the UK.

## **1. Introduction**

This research was carried out by University of Southampton and The Open University's Integrated Waste Systems research group. The project has been funded partly by The Veolia Environmental Trust through the Landfill Tax Credit Scheme (LTCS) and partly through the EPSRC's Sustainable Urban Environment (SUE) programme. Additional funding has been given by Hampshire County Council and South East England Development Agency (SEEDA). Support and advice has been provided by a project advisory panel which included representatives from Hampshire County Council, SEEDA, The Environment Centre Southampton, and the Environment Agency.

The key objectives of the project were to develop a robust methodology for auditing commercial and industrial (C&I) wastes from small and medium sized enterprises (SMEs<sup>\*</sup>) and to provide data that can be used to identify the infrastructure opportunities to optimise the combined recovery of key resource streams. The methodology was tested within Hampshire, on the food and food-related business sector and with a focus on the smaller SMEs (small and medium-sized enterprises) which comprise the majority of businesses. It aimed to provide a framework in which business, local authorities and the waste management industry can work to optimise the recovery and re-use of key resource streams. By correlating the findings with household waste data in Hampshire some possible opportunities for combined recovery and the potential gains from a comprehensive integrated approach to management of municipal and C&I waste can be explored.

The project has comprised a number of stages, which are described in detail in the following Chapters. The first is summarised in Chapter 3 and involved reviewing and collating existing reports and data on C&I wastes. This information base was used to inform and develop a resource classification that would be suitable for assessing the composition of C&I waste with the survey questionnaire.

The methodology for surveying and assessing the amount and resource composition of waste from SMEs involved developing and using a 'smart' interactive questionnaire which is described in Chapter 4. This both allows accurate information gathering, but also gives feedback to individual businesses on how to maximise their waste management opportunities. The latter aspect was considered important in the success of delivering the survey as this is critically dependent on cooperation offered by the business community, and to maximise this, the survey work needed to be perceived as offering real and tangible benefits.

The main aim of carrying out a case study survey was to test the methodology, both in terms of usability and the level of detail obtained in assessing waste arisings from these businesses, particularly those smaller businesses where there is a paucity of accurate data. The survey design, analysis and results are covered in Chapters 5, 6, 7 and 8. Chapter 5 describes the approach taken to the survey design.

Information was gathered on the business profile in Hampshire in preparation for the case study. This data was then used to develop a sampling framework based on business type and key resource streams, and existing knowledge from the Environment Agency's earlier 1999 survey (EA, 2000 & 2004). The survey was carried out face-to-face and results were analysed primarily in relation to data obtained for the specific SIC code groups and types of

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<sup>\*</sup> SMEs are usually defined as businesses employing less than 250 people; with medium enterprises having 50-249 employees, small enterprises 10-49 employees and micro businesses 1-9 employees.

businesses surveyed, exploring the accuracy of assumptions about average or typical waste arisings for these business types. A small subset of the businesses surveyed then had samples of their waste taken for weighing and analysis to provide some check on the data produced by the survey.

Chapter 6 presents the statistical analysis of the survey results for each of the business types in the food sector – food and drink manufacturing, food and drink wholesale, non-specialist retail selling food and drink, food and drink specialist retail, and the hospitality sector including hotels, restaurants, pubs & bars. Estimates for average waste per employee and per business, waste composition, how waste materials are collected for disposal and recycling, and recycling rates are included.

In addition to data on waste arisings, businesses were asked to comment on their experience of both using the questionnaire and concerns about waste issues as they affect their business activities. Chapter 7 summarises the key issues that arose from these comments, and provides some insight into the attitudes held by these SMEs on recycling. Many of these focused on the barriers they face and how these may be tackled, but also highlighted some positive attitudes and perceived opportunities.

In Chapter 8 using the survey results for the specific business types and knowledge of the business profile, the data was grossed-up to the food sector SME waste stream for the whole of Hampshire. This produced estimates of the resources generated by this sector across Hampshire, and draws comparisons with household waste arisings in the County.

The applicability of the methodology design for use with large public bodies/institutions was investigated in the project and described in Chapter 9. The premise explored here was whether and how the questionnaire could be adapted to deal with two example institutions as comprising a ‘business profile’ of a number of small units each acting like an SME in respect to its waste arisings.

The approach to auditing wastes from SMEs developed by this project can be used to generate a resource map of C&I waste resources which together with data on household or municipal solid waste (MSW) can be used in planning infrastructure needs, in identifying opportunities for new businesses to develop using the resources reclaimed from waste, and in mapping the way forward for the sustainable management of C&I waste in the UK.

## 2. Context

Government figures estimate the amount of commercial and industrial (C&I) waste generated in England in 2002/3 was just under 70 million tonnes, between 2.5 and 3 times the amount of household waste produced in the same year (Defra, 2006). Although the former has an overall higher record for recycling and recovery at 45% in 2002/3, the material disposed of still represents a considerable untapped resource. In a report for the Environment Agency in England, Cambridge Econometrics and AEA Technology estimated that UK manufacturers throw away 7% of profits in wasted natural resources (CE and AEAT, 2003). Municipal solid waste (MSW) and household wastes have received considerable attention in recent years driven by EU and national policy agendas to divert wastes from landfill and increase recovery and recycling of resources. Recently the agenda has begun to focus more on improving the resource efficiency and management of waste from the commercial and industrial sector, and in particular from SMEs – the least understood sector in terms of wastes produced, its composition and potential for minimisation, greater recovery and recycling.

Apart from the broad overview national waste surveys carried out by the Environment Agency (EA) in 1999 and in 2002/3 in England and Wales (EA, 2000 and 2005) and by SEPA in Scotland in 2005 (McLaurin et al, 2006 and Curry, 2005), surprisingly little research has been carried out to obtain accurate information on the quantities, nature and distribution of these wastes. Even less has been done towards development of an infrastructure through which the natural resources present within them can be recovered. One reason is that the waste management industry is relatively fragmented in this area, with multiple operators providing services on an individual contract basis, and little incentive offered for traders to separate their wastes.

*Why focus on SMEs?* The EA 2002/3 survey (EA, 2005) concludes that around half of the total C&I waste in England and Wales is produced by SMEs, the other half by large companies with more than 250 employees; however the split is markedly different when commercial and industrial wastes are separated, with SMEs accounting for only 1/3 of industrial wastes but 2/3 of commercial. The recent review of England's waste strategy (Defra, 2006) quotes 40% of C&I wastes as coming from SMEs but described these as companies with less than 50 employees which are generally defined as 'small' businesses (with medium sized being 50-250), showing the significance of the smallest companies in waste production. Recycling overall is higher for industrial waste (47%) compared to commercial (37%). It is also likely to be higher for large companies than for SMEs as concern is often expressed about the lack of opportunity and infrastructure for small businesses to engage in recycling.

The waste strategy review in England recognises 'smaller businesses often have particular difficulties in obtaining affordable recycling and recovery services', and points to improving linkages across different waste streams as a way to improve this situation: "it is a matter of concern if we are failing to capitalise on economies of scale in the management of different types of waste" (Defra, 2006). It refers to potential benefits from aggregating demand (between municipal and other waste) through developing critical mass to procure services, build economically scaled facilities, and a better price for supply of greater volumes of recycled materials to the market. The review also comments that stakeholders pointed out that small businesses face particular difficulties because they do not have sufficient incentive, influence or capacity to secure environmentally beneficial solutions. A report commissioned by the Chartered Institution of Wastes Management (CIWM) (SLR, 2005) found that



experience in countries with better landfill diversion records than the UK suggest that most of them have greater integration of the management of different waste streams. They concluded that the integration of strategic planning for municipal and industrial wastes played a key role in higher recycling levels.

Another important aspect here concerns attitudes and behaviour. In research about public attitudes to recycling and promoting sustainable behaviours the link between recycling in the workplace as well as in the home has been cited in the context of 'normalising' recycling behaviour and encouraging more people to recycle as a habit (Thomas, 2004). Engaging SMEs in waste reduction and recycling issues could hence help promote and achieve behavioural change beyond the workplace.

Local authorities could potentially play a significant role in this; they already collect some commercial waste from small businesses such as shops, small trading estates, council offices and local parks and gardens, but this accounted for only 3.7 million tonnes in 2002/3, around 10% of waste generated by SMEs. They are though the most likely source of information, especially for the smallest companies; a survey by NetRegs (EA, 2005) found that 61% of SMEs would ask their local authority for guidance on environmental issues and in securing recycling services. It is clear that awareness amongst small businesses of waste regulations is low with the Waste Management Licensing Regulations recognised by only 35% and Duty of Care Regulations by 32% of SMEs (EA, 2005); and the penetration of initiatives to help them manage resources more sustainably such as BREW, Envirowise and NetRegs is also poor amongst small businesses (CE and AEAT, 2003; EA, 2002 and WS Atkins, 2003).

The strategy review discusses the type of role that local authorities could take on including strategic planning, providing information and advice, or providing recycling services through collection or CA sites. Similarities in the potential resources in wastes from small businesses and MSW suggest co-collection and processing opportunities, but more information on the SME waste stream is needed for this to be realised. A survey of retail businesses in Cardiff city centre carried out in 2002/3 concluded that waste types from retail sector are not dissimilar to municipal waste, but that the quantities are much larger (Frater, 2004). Some authorities are already moving in this direction; including Hampshire's Material Resources Strategy consultation (HCC, 2005) and the publication by the Local Government Association (LGA, 2005) of examples of initiatives. However much more needs to be done, especially by Government if they are to be enabled to take further action.

*Why focus on the food sector?* The economic flows represented by the food chain account for about 8% of UK's GDP and waste from food and drink related business is estimated in the Draft Food Industry Sustainability Strategy at 10% of the C&I waste stream (Defra, 2005). Food and drink manufacturing is the largest manufacturing waste producer, with over 7 million tonnes in England in 2002/3. Retail, of which a good proportion is food related, produces the most waste of any commercial or industrial sector – over 12 million tonnes in 2002/3. Food manufacturing, all retail and wholesale and the hospitality (hotel and catering) sectors together account for nearly 1/3 of all C&I waste.

A 'Mass Balance' study of food and drink processing in the UK estimated that biodegradable wastes exiting the sector amounted to just under 2million tonnes, out of a total waste stream of nearly 6million tonnes (C-Tech Innovation, 2004). 'Food' waste across all sectors was estimated at 2.6 million tonnes and of this 69% was recovered, reused or recycled. This only includes food waste that can be identified as such, not food waste mixed in general categories, and hence only a proportion of the resource available, and diversion of biodegradable waste from landfill is an issue of particular current relevance. Other wastes from this sector are also significant, in particular packaging, but often present difficulties in

recycling particularly where the sources are small and micro businesses. WRAP are currently carrying out trials aimed at improving recycling services for SMEs in the hospitality sector, and make recycling more convenient and cost effective for them – including glass recycling for pubs, clubs and restaurants, catering food wastes for pubs, hotels and restaurants and a collection service for paper, card and glass for inner-city hotels (WRAP, 2006). A study by the Centre for Environmental Studies in the Hospitality Industry at Oxford Brookes University estimated that 600,000 tonnes of glass bottles are thrown away each year by licensed premises, up to 90% of which, worth an estimated £9million, end up in landfill (CESHI, 2004).

Any initiative to increase recovery and recycling of resources from C&I waste needs good reliable data on the amounts and composition of those waste streams. This research programme was designed as a step towards providing that data through the development of an effective methodology for gathering statistically reliable data on C&I wastes, in particular those produced by smaller companies and sub-units of larger organisations. Generalised questionnaires for waste auditing have not captured sufficiently accurate data, especially in the SME sector. With better data local strategies for recovery of C&I wastes can be rationalised and rethought to make best use of the existing infrastructure, determine the need for additional facilities, and open up communication routes between business and local authorities to allow business to participate in the most cost-effective way. In a discussion paper on moving from waste to resource management, Lisney, Riley and Banks suggested that ‘a smart resource management approach integrates the processing of household, commercial and industrial wastes to the benefit of both the council taxpayers and of commerce and industry. This requires a new mindset of categorising waste by resource type linked to optimum processing requirements, rather than by origin as happens now’ (Lisney et al, 2003).

### **3. Review of literature on the resource potential of C&I waste from SMEs**

#### **3.1. Literature review**

The focus of this research was developing a methodology for auditing C&I wastes from SMEs in food related sector activities. An initial stage of the work involved reviewing relevant literature and exploring previous related work in this area to ensure the research built on previous experience and didn't duplicate existing knowledge. This review covered the following issues:

- previous waste audit studies of C&I waste;
- resource / waste classifications for assessing waste composition;
- questionnaire designs used in previous audits;
- SME recycling and waste minimisation studies;
- food and drink sector studies relating to environmental performance, waste management and mass balance studies;
- business profile studies and information on SMEs;
- survey and sampling techniques.

Relatively few waste audit studies of commercial and industrial sectors were available and very little specific to SMEs. The most comprehensive research was that carried out by The Environment Agency (EA) and the Scottish Environmental Protection Agency (SEPA), both of which provided useful background and comparative data for this research. The EA surveys of England and Wales were carried out in 1999 and 2002/3 (EA, 2000 and 2005); the latter involving Brass (Business Relationships, Accountability, Sustainability and Society Centre) at Cardiff University in carrying out the Welsh survey (BRASS, 2005). The SEPA audit was based on a pilot survey carried out in 2004 (Curry, 2005) and then further analysed to produce estimates for Scotland (McLaurin et al, 2006).

Direct comparison of results from these surveys with the data from this project was limited to the food and drink manufacturing sector for the EA and SEPA surveys, and the hotel and restaurant sector for the SEPA survey, as these were the only areas where the classification of business types matched. However some additional comparative data was available from the EA 1999 survey through communication with the EA and by engaging Julian Ellis, a statistician working with the EA, to extract some relevant data for the project. In particular this was used for devising the survey sampling framework and in density conversions.

Other C&I waste audits studies reviewed included surveys carried out in the West Midlands, Surrey, Oxfordshire, Andover, Staffordshire and the Yorkshire and Humber region (MEL, 1993 + 1999; Oxfordshire CC, 2005; Padelopoulos, 2003; Whittaker, 2004; SWAP, 2005).

Questionnaires used by some of these studies were examined to see what lessons could be learnt in developing the types of questions asked in this survey. These included questionnaires used in the EA industrial and commercial waste surveys 1999 and 2002/3; the BRASS Welsh commercial and industrial waste survey 2003; Oxfordshire County Council's business waste survey 2005; WAMTEC (University of Sheffield) SME waste audits; and Hampshire County Council's business recycling at HWRCs trial survey 2003.

Experience was also sought from The EA, BRASS and others involved in environmental audit work, such as The Environment Centre, Southampton. These questionnaires were all

paper based and, although useful background information, they were mostly not entirely suited to the type of questioning needed for an interactive computer based questionnaire.

Developing the business profile and the survey and sampling techniques are discussed in detail in Chapter 5, and built on both existing knowledge and a review of relevant literature. Information on the business profile of food related business sectors was mainly gathered from the statistical and database sources listed in the references and sources of information (Chapter 11.2), but additional information on SMEs in these sectors was sought from wider business focused research and some relevant work is listed in Chapter 11.3. Survey and sampling techniques were explored through various statistical sources including Sapsford (1999), Hunter (2001) and through advice from Julian Ellis, who was engaged in a consultative capacity for this specific activity.

A range of information sources are included in the Chapter 11.3 which cover reports and research outputs from studies concerned with commercial and industrial recycling and waste minimisation particularly that concerning SMEs, and food and drink sector studies relating to environmental performance and waste management. Some of these were specific case studies of different business types, such as fast-food restaurants, hotels or licensed premises, whilst others focused on providing advice to businesses on how to achieve waste minimisation such as information from Envirowise (<http://www.envirowise.gov.uk>) and NetRegs ([www.netregs.gov.uk](http://www.netregs.gov.uk)). Mass balance and eco-footprint studies related to food or retail were reviewed and these contributed a useful perspective of resource flows and waste arisings.

### 3.2. Resource classification

A waste survey is a tool, and must be set in context of relevant aims and objectives. A key aspect of the research was in identifying the potential for improved recovery and recycling, and hence it was important that the compositional categories used in the audit focused on identifying the key resource streams. Identifying key resource streams for SMEs requires a waste classification system that satisfies these criteria:

- focuses on the key resource streams for recycling (need enough information to identify whether material can be recycled);
- focuses on the main categories of waste arisings from SME's;
- is compatible with classifications used for MSW and household waste compositions;
- is compatible as far as feasible with the European Waste Catalogue (EWC) for comparability with the EA survey, and other waste data being recorded.

The categories for the key resource streams for the classification were developed initially from that outlined in Lisney et al (2003). These were derived from previous classifications and criteria developed by the Zero Waste movement for the 12 master categories of recyclable materials (Knapp, 1999 and Murray, 2002). These key resource streams are shown in Table 3.1.

Key resource streams	
Organic	Furniture, furnishings & non-electrical office equipment
Wood	Electrical & electronic equipment / WEEE
Paper and card	Chemicals and potentially hazardous
Textiles	Glass and ceramics
Plastics	Construction and demolition
Metals	

**Table 3.1: Key Resource Streams**

Prior to developing the full classification for the audit survey, research was undertaken which involved collating existing data on C&I wastes and classifications used, as well as classifications for household waste and MSW. A full resource based waste classification for C&I waste needed to be compatible with classifications for MSW if opportunities for combined collections and infrastructure were to be explored as an outcome of this research.

The main C&I waste classifications that were reviewed included those used in the EA 1999 and 2002/3 C&I surveys, SEPA's recent C&I survey in Scotland and the MEL and Viridis studies (EA, 2005, Hunter, 2001, Brass, 2005, Curry R, 2005, MEL, 1999 and Whittaker, 2004). For compatibility with MSW classifications the research compared those cited in Defra's waste composition analysis guidance (Defra, 2004); that proposed in the WRAP report to the Strategy Unit's report 'Waste not, want not' (Parfitt, 2002); those used in the Welsh Assembly survey (AEAT, 2003) and by SEPA in Scotland; as well as the classification used in the last Hampshire waste analysis survey (PI, 1999).

The review took into account the purpose of different surveys which influence the classification that is most appropriate. The classification used in the National Household Waste Analysis Project (NHWAP) (DOE, 1994), as well as several local authority surveys was originally developed by the Warren Spring Laboratory as an 11 category system, and then extended into 32 categories. The original classification was developed during the 1970s and 1980s with the main aim of determining the potential of waste as a fuel. The larger classification was developed later to give more information on the potential for recycling. Classification systems need to evolve to account for developments in policy and legislation, and consequently this is no longer appropriate for providing information on different types of compostables (kitchen waste cooked or raw), on waste electrical and electronic equipment and hazardous household wastes.

The classification system developed in the WRAP paper on MSW composition for the Strategy Unit did this by condensing some of these 32 categories (e.g. newspapers and magazines into one category; ferrous and non-ferrous food and beverage cans and foil into one category of metal cans and foil) and including additional categories (e.g. kitchen waste, engine oil, wood, furniture).

The system used in the MSW study in Wales started from a list of general descriptions that led to 13 basic categories. Initially these were expanded into a 76 category classification that was used during the pilot survey, but was found to be too detailed. Most of the sample population had a small number of categories, and nearly half of the categories were found in less than 10% of the samples. Using a large number of categories runs the danger of data capture too small to run statistical analysis. Following the pilot experience, the number of sub-categories was reduced to 37 (AEAT, 2003).

A classification was devised that was mainly based on, and compatible with, the Welsh classification but moderated to take account for those materials likely to be more prominent in C&I wastes and reduce the emphasis on some MSW resource components that would be unlikely to feature in this waste stream.

With all these issues in mind, it was concluded that a cascading structure for the classification of these wastes was needed based on twelve main resource streams, which are sub-divided into 25 main waste categories, and further into 59 more specific sub-categories to allow more detailed interrogation of resource types where such data was available. The main resource and waste categories are given in Table 3.2, and the full classification in Appendix 1.

Main resource streams	Main waste categories
Organic	organic food waste
	organic non-food waste
	other organic
Wood	untreated wood
	treated wood
Paper and card	newspapers & magazines
	other paper
	card and board
Textiles	textiles
Plastics	dense plastic
	plastic film
	other plastics
Furniture, furnishings & non-electrical office equipment (not metals)	furniture, furnishings & non-electrical office equipment
Metals	ferrous metal
	non-ferrous metal
	metal furnishings & non-electrical office equipment
Electrical & electronic equipment / WEEE	electrical & electronic equipment
Chemicals and potentially hazardous	chemicals
	potentially hazardous
Glass and ceramics	packaging glass
	non-packaging glass
	ceramics
Construction and demolition	construction and demolition
Unclassified waste	mixed general waste
	other not classified above

**Table 3.2: Waste Classification Scheme**

There were some compatibility problems with the European Waste Catalogue (EWC) which is process rather than material orientated, which in turn caused problems for comparability with the EA 2002/3 survey. The EWC groupings are fairly broad and only allow some mapping of our classifications on to the EA's. Despite this issue it was felt that for this project a resource based classification was essential, and that should be the primary aim of the data capture.

Data was captured in the survey at as detailed a level as was known to the interviewee, but overall results on resource composition is focused on the 12 main categories, with some further analysis at the second level of main waste categories for profiling C&I waste composition in the audit. Information captured at the more detailed level of 59 categories if available offers too many categories for overall levels of statistical validity given the survey size, but provides some distinctions which may prove useful in parts of the analysis and may provide insights into major resource recovery opportunities.

## **4. Methodological approach to the survey questionnaire**

A key issue for the research in assessing waste arisings from small businesses was that many do not have an accurate record of how much and of what type of wastes they throw away. If these wastes are collected as part of a service with multiple collection pick-ups as is the case for most small businesses then individual waste arisings from each business is unlikely to be recorded. The challenge was to question and record as accurately as possible what wastes each business created. The questionnaire has been developed focusing on food production, food retailing and food service sectors for face-to-face delivery by interviewers.

In developing the methodology, the approach chosen was uniquely based on the development of a computer-based interactive waste auditing tool ('smart questionnaire') which facilitates interrogation of a series of embedded databases to provide appropriate option selection and error-trapping of data to minimise false entries. It was designed in a way that eliminates some of the problems associated with traditional, paper-based questionnaires such as their generalised nature and inability to error-trap.

To achieve this, the smart questionnaire is constructed using an expert-system approach with both rule-based and hierarchical programming. It adapts the questions asked according to the user's responses, thus avoiding irrelevant and confusing information. A further key feature of the smart questionnaire is its ability to limit the questions asked to those relevant to the company being audited, thus saving time and avoiding 'customer annoyance'.

Problems such as the units in which waste is quantified are overcome by using internal conversion factors, thus allowing the respondent to specify quantities in terms with which he/she is familiar. A variety of techniques including photos, prompts, selective lists and pop-up information boxes are used to obtain more accurate information on waste generation and to overcome some of the problems encountered in earlier research on the conversion of volumetric to weight-based data. These are employed throughout to assist the interviewee and speed up the questioning process. A further advantage is that the information is already in digital database format, alleviating the need for manual data entry with the errors this entails.

The use of in-built databases also allows for direct feedback to the company to satisfy an essential criteria for engaging business participation – that of providing an incentive for taking part, sometimes referred to as the "what's in it for me?" syndrome. As well as comparative data on their waste audit, this might include information, based on local knowledge, of the nearest recycling facilities or outlets, and about the regulations and legislation that is relevant to the particular business being surveyed.

### **4.1. Questionnaire design**

The questionnaire uses simple questions which are tiered to seek information regarding the company's activities and waste load. By focusing on questions about (i) containers used and frequencies of collection, matching these to data from waste disposal operators on volumes, and (ii) on the material types disposed of or recycled in each waste container, the approach builds a picture of the wastes from each business. A full description explaining step-by-step the information sought and approach to questioning incorporated in the questionnaire is given in Appendix 2.

The questionnaire was designed using Microsoft Internet Explorer web browser as the platform running on a standalone computer acting as a web-server. The programme was written in htm (hypertext mark-up) language, with javascript coding and employing Microsoft Access databases for the built-in data sources.

During piloting the survey it became clear that although all possible options for the removal of material had been considered when developing the questionnaire, interviewees only seemed to give details for removal of what they considered to be “waste”. However, it often became clear further on into the questionnaire that they had not mentioned all material that left their business, and that could be considered as waste/recyclables. For instance, glass taken to a bottle bank; this was despite the fact that one of the removal options was “Material is taken to one or more Recycling Banks by a member of staff”. The reason for this seems to be that the interviewee was focusing on “waste” and did not consider glass taken to a recycling bank to be waste.

Therefore, an introductory ‘prompt’ page (Figure 4.1) was created and inserted after the front page of the questionnaire. This was designed to make the interviewee think about all the different types of material that they generate and deal with, that can be considered waste or recyclables. The page was tailored towards the food and food-related sectors being surveyed and included examples of typical materials that they might generate. This effectively gave the interviewer a checklist that they could go through with the interviewee in order to prompt them to give details of the types of material they generate, and what happens to it. Then, when it comes to giving details later, the interviewee will be less likely to forget material/removal option.

**what is the aim of wasteQUEST?**

we want to find out about all the different types of waste - and recyclables - that you produce, and all the different ways that it leaves your business (or even dealt with by yourself)...

✓	'Mixed waste' that is removed by your Local Authority or a private waste company, or you take to the tip (HWR, C.A site) or home	✓	'Recyclables' such as cardboard, paper, plastic bottles, plastic film, glass bottles, etc., that are collected separately from your mixed waste, or you might take them to a recycling bank or home (to put in your recyclables bin)
✓	Vegetable oil (and fat) and/or Animal oil (fat) that is collected separately	✓	Meat trimmings, offcuts, bones, etc. that are collected separately
✓	Anything such as leftovers or food items (e.g. past sell-by date) that staff take home, or you might give to a charity	✓	Things such as fluorescent (strip) lights that don't go into the mixed waste, but are collected separately
✓	Clinical waste (e.g. feminine hygiene material) that is collected separately	✓	Material that you deal with yourself on-site: examples might be garden waste that you compost or burn; cardboard and paper you burn, etc.
✓	Anything else that is collected separately, or is removed by someone else - this might be another business or even your customers; for example, they might take away empty containers, crates, cardboard boxes, wooden pallets, etc., to use themselves		

...but we only want to know about what's produced by your business...

[NEXT PAGE =>](#)

**Figure 4.1: Introductory prompt page**

There are six main areas interrogated by the questionnaire: business details, waste routes and disposal methods used by the business, the containers used for this, and the types and amounts of waste generated by the business, occasional wastes, and waste awareness.

A major part of the questionnaire is concerned with gathering information about the disposal methods used by the business, the containers used for this, and the types and amounts of waste generated by the business. This is only for material that is removed from the business on a regular basis, i.e. with a frequency of collection of at least about once a month. Detail of



material that leaves the business on a less frequent basis is collected further on in the questionnaire.

#### 4.1.1. Business details

Establishing business details includes the name of the interviewee, their job title, the name of the business, its location, and its main business activity, facilities and secondary activities, business premises, number of employees (both full and part-time and full time equivalent) and times the business operates.

The combination of business name and location is used to search the database of approximately 5000 food and food-related businesses identified within Hampshire from various sources (FAME, Yellow Pages, ONS, etc.). The location has been used here as a means of filtering the businesses in order to limit the number of matches. If a match for the business/location combination is found within the database, then the address details are displayed or option given in a drop down menu; if a match is not found, then the address details can be entered manually.

The address details are stored in the database for later use in tailoring feedback to the business and potentially for geographical mapping for future infrastructure planning.

Next, the ‘main’ activity of the business is selected from a list, specific to the food and food-related business sectors. A summary of the different SIC groups associated with each activity is shown in Table 4.1; the full list of SIC codes within each group is given in Appendix 3.

	SIC code group(s)	Description
1	15.1 – 15.9	Manufacturing
2	51.17, 51.3	Wholesale
3	52.1, 52.2	Retail
4	55.1	Hotel
5	55.2	Guesthouse, campsite or similar
6	55.3	Restaurant, café, takeaway or mobile food stand
7	55.4	Public house, bar, club
8	55.5	Canteen or catering

**Table 4.1: Questionnaire SIC code groups and descriptions**

The questionnaire does not ask for SIC codes directly but generates these from description of their business activities which are compared with both lists of keywords and lists of SIC code descriptions. The programme filters the search, such that matches are only given for those SIC codes within the main activity group chosen. If the results displayed do not provide a match, then the ‘none of these’ option can be selected. The programme will then route the questionnaire to an alternative SIC code generator which uses a hierarchical system of questions designed to guide the interviewee to their business activity in as few steps as possible, and the database updates itself with new key descriptors. The flow diagram for the manufacturing SIC code generator is given in Appendix 4 as an example of how it works. The SIC code digits are not revealed to the user, but recorded in the database only so that the interviewee thought processes are not sidetracked.

Questions related to business premises concern whether they are owned or leased/ rented/ managed, shared with other businesses, and how much storage space they have for waste and whether this is shared with other businesses and how many. This is mainly background

information which may be useful in checking waste data against constraining factors on waste management operations.

It should be mentioned that no questions about business income or turnover are asked. As the questionnaire is not being used by a government agency directly, businesses would be under no obligation to divulge this, what is often seen as sensitive, information and it was expected that questioning of this nature would lead to businesses not wanting to take part. Size banding is done on staffing levels alone.

Since the size of the business may be very small, then the number of staff should include everyone who works there, including owners. The interviewee also has the option to give an estimate of staff levels if they cannot give a precise figure. In addition, any variation in staffing levels throughout the year can be logged; this is divided into the four seasons of the year. However, if the business can only give an estimate of its current staffing levels, then this question is not asked since it is likely that any variation would lie within the original size range estimate.

Details of the hours per day, days per week and weeks per year that the business operates is recorded. These questions are asked, as they may help to explain differences in waste generation for similar businesses. Also, it is important to know if the business is closed for any length of time (excluding standard public holidays), since this may affect the calculation required to determine the annual levels of material generated.

#### 4.1.2. Waste removal or disposal options

The interviewee is first asked to select the different disposal options that they use (Figure 4.2) and separate information is then collected for each option positively selected. A flow diagram for this section can be found in Appendix 5. This is only for material that is removed from the business on a regular basis, i.e. with a frequency of collection of at least about once a month. Details of material that leaves the business on a less frequent basis is collected further on in the questionnaire

DISPOSAL OPTIONS - HOW DOES WASTE, RECYCLABLES AND OTHER MATERIAL LEAVE YOUR BUSINESS?

---

Please go through the list indicating by ticking the *YES* (green) or *NO* (red) check box whether you use that option, and then click the SUBMIT button.

YES	OPTION:	NO
<input checked="" type="radio"/>	Removed by my Local Authority	<input type="radio"/>
<input type="radio"/>	Removed by a private Waste, Recycling or Reprocessing Company	<input type="radio"/>
<input type="radio"/>	Material is sent back to a central depot or similar (back-filled/back-hauling)	<input type="radio"/>
<input type="radio"/>	It is removed by another business to use as a material for their process	<input type="radio"/>
<input type="radio"/>	My business takes it directly to a waste transfer station	<input type="radio"/>
<input type="radio"/>	My business takes it directly to a landfill site	<input type="radio"/>
<input type="radio"/>	Material is donated to a Charitable Organisation or Community Group	<input type="radio"/>
<input type="radio"/>	Material is taken to one or more Household Waste Recycling Centres (Civic Amenity sites) by a member of staff	<input type="radio"/>
<input type="radio"/>	Material is taken to one or more Recycling Banks by a member of staff	<input type="radio"/>
<input type="radio"/>	Material is taken home by a member of staff	<input type="radio"/>
<input type="radio"/>	Material leaves my business by another way not given above	<input type="radio"/>
<input type="radio"/> do not know / not sure		

**Figure 4.2: List of disposal options**

The main disposal routes are: removed by local authority; by private waste, recycling, or reprocessing company; or material sent back to a central depot or similar. Other options

listed include: removed by another business to use as a material for their process; business takes it directly to a waste transfer station; business takes it directly to a landfill site; material donated to a charitable organisation or community group; material taken to HWRC by a member of staff; material taken to recycling bank by member of staff; material taken home by member of staff; material leaves business by another way.

If the interviewee indicates that their Local Authority removes waste/recyclables from their business then the programme displays the name of the local authority, using the database of postal towns and boundaries and the business address, and asks the interviewee to confirm if this is correct or not. If incorrect, then the interviewee can manually enter the name.

The questionnaire checks that responses match known information, with prompts such as “from your address, your business seems to be in an area where the Local Authority does not collect commercial waste. Are you sure that this waste is removed by your Local Authority? This provides an opportunity to check the information but doesn’t stop it being entered. It should be noted that generally, the questionnaire has been designed in a flexible manner; i.e. the selections provided are not rigid – there is always an ‘other’, ‘not sure’, etc., option in order to prevent the interviewee from being forced to select an option that is not of their choosing; if they did not make such a selection, then they would not be able to proceed. In essence, this aspect ensures trapping of inherent errors of questionnaires of this type.

If waste is removed by private waste, recycling, or reprocessing company, a pop-up list of the most common companies operating within Hampshire is provided (Figure 4.3). The interviewee can then simply select the appropriate companies from this list; if the name of a company they use is not on the list, then it can be entered manually.

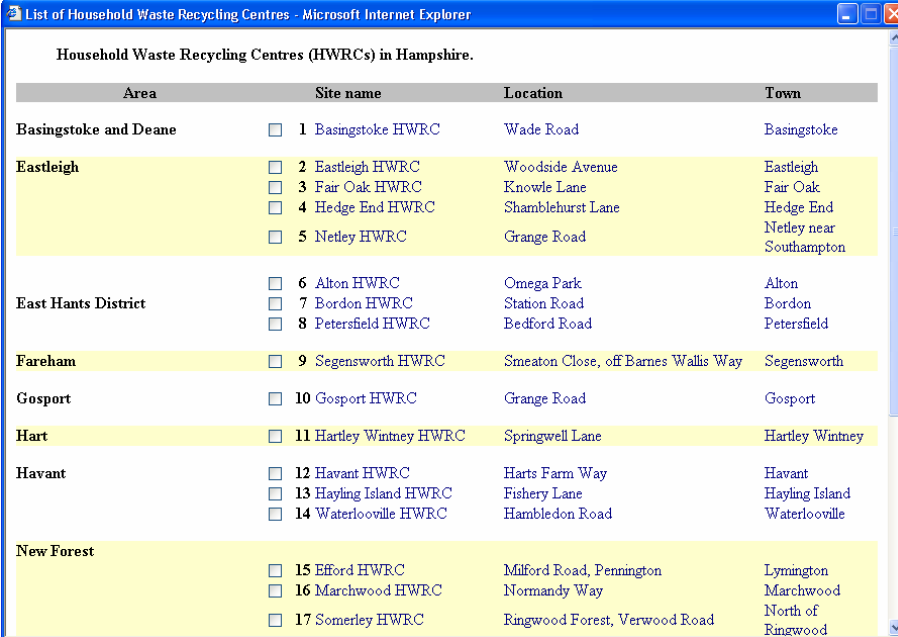
LIST OF PRIVATE WASTE, RECYCLING OR REPROCESSING COMPANIES THAT OPERATE IN HAMPSHIRE:	
	Operator
1	<input type="checkbox"/> A&B Oil Waste Cooking Oil & Fat Collection Services
2	<input type="checkbox"/> Associated Polymer Resources
3	<input type="checkbox"/> Bakersfield
4	<input type="checkbox"/> Biffa
5	<input type="checkbox"/> Cleanaway
6	<input type="checkbox"/> Dove Recycling
7	<input type="checkbox"/> Hampshire Waste Services/onyx
8	<input type="checkbox"/> Hazchem
9	<input type="checkbox"/> Hippo Waste
10	<input type="checkbox"/> J & W Recycling Ltd
11	<input type="checkbox"/> Onyx
12	<input type="checkbox"/> Proveda (UK)
13	<input type="checkbox"/> RMS Waste Disposal Ltd
14	<input type="checkbox"/> SCA Recycling
15	<input type="checkbox"/> SERCO
16	<input type="checkbox"/> Shanks
17	<input type="checkbox"/> SITA
18	<input type="checkbox"/> Vindor
19	<input type="checkbox"/> Waste Services (UK) Ltd

**Figure 4.3: List of private companies operating in Hampshire**

Material sent back to a central depot or similar is generally for businesses that use backfilling of material, for example supermarkets, where vehicles that are used for delivery of goods are then used for removal of waste/recyclables back to a central depot. For this option, the interviewee can enter details of where material goes (i.e. its location), and a brief description of the material sent back.

Other routes, although less used, were recorded by some businesses in the survey. Some waste materials are removed by another business to use as a material for their process, such as meat and bone offcuts used by another business as fertiliser. Sometimes a member of staff takes home materials from the business, for example leftovers, and details of this are recorded too.

Members of staff also take waste materials to Household Waste Recycling Centres (HWRCs) or recycling banks. To assist the interviewee with identifying the particular HWRCs or recycling banks that they use, a pop-up list has been provided (Figure 4.4 shows that for HWRCs).



Area	Site name	Location	Town
Basingstoke and Deane	<input type="checkbox"/> 1 Basingstoke HWRC	Wade Road	Basingstoke
Eastleigh	<input type="checkbox"/> 2 Eastleigh HWRC	Woodside Avenue	Eastleigh
	<input type="checkbox"/> 3 Fair Oak HWRC	Knowle Lane	Fair Oak
	<input type="checkbox"/> 4 Hedge End HWRC	Shamblehurst Lane	Hedge End
	<input type="checkbox"/> 5 Netley HWRC	Grange Road	Netley near Southampton
East Hants District	<input type="checkbox"/> 6 Alton HWRC	Omega Park	Alton
	<input type="checkbox"/> 7 Bordon HWRC	Station Road	Bordon
	<input type="checkbox"/> 8 Petersfield HWRC	Bedford Road	Petersfield
Fareham	<input type="checkbox"/> 9 Segensworth HWRC	Smeaton Close, off Barnes Wallis Way	Segensworth
Gosport	<input type="checkbox"/> 10 Gosport HWRC	Grange Road	Gosport
Hart	<input type="checkbox"/> 11 Hartley Wintney HWRC	Springwell Lane	Hartley Wintney
Havant	<input type="checkbox"/> 12 Havant HWRC	Harts Farm Way	Havant
	<input type="checkbox"/> 13 Hayling Island HWRC	Fishery Lane	Hayling Island
	<input type="checkbox"/> 14 Waterlooville HWRC	Hambleton Road	Waterlooville
New Forest	<input type="checkbox"/> 15 Eford HWRC	Milford Road, Pennington	Lymington
	<input type="checkbox"/> 16 Marchwood HWRC	Normandy Way	Marchwood
	<input type="checkbox"/> 17 Somerley HWRC	Ringwood Forest, Verwood Road	North of Ringwood

**Figure 4.4: List of HWRCs in Hampshire**

Businesses might take material directly to a waste transfer station or landfill themselves, and these options are included for completeness, to ensure that all possible removal options have been considered.

#### **4.1.3. Waste containers used**




For each of the removal options selected in the previous section, the questionnaire now gathers information about the type and number of different containers used for removal of material from the business. Images and descriptions of the bins are given in an attempt to give the user as much information as possible in order to make the right choice.

First the questionnaire deals with material removed by a local authority or private waste, recycling, or reprocessing company. The business is asked for details of the type and number of different containers that are provided by their local authority or waste company to remove waste/recyclables from their business. The questionnaire has been designed so that the list of different containers displayed here is dependent upon the actual local authority or company used by the business, which is stored in a database and accessed at this stage so that the appropriate list of containers can be displayed here, rather than giving a list of all the possible different containers that might possibly be provided. Figure 4.5 shows part of a page of container types for a local authority.

Local Authority **Onyx** central depot Removed by another business Direct - Waste Transfer Station Direct - Landfill Site Donated - Charity, etc. Staff - HWRC

Staff - Recycling bank Staff takes home burnt

**SOUTHAMPTON**

	Number you have for Mixed waste	Number you have for One type of waste	Number you have for Mixed recycle	Number you have for One type of recycle	Total
 240 wheellie bin two-wheeled; volume 240 litres (8 cubic feet or about 4 rubbish sacks)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
 360 wheellie bin two-wheeled; volume 360 litres (12 cubic feet or about 6 rubbish sacks)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
 1100 euro bin	<input type="text" value="1"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text" value="1"/>

**Figure 4.5: Example of Local Authority details page**

The interviewee can then select which containers they have from this list, giving the number of each type of container they use and for what type of material i.e. whether mixed waste, one type of waste, mixed recycle or one type of recycle. In addition, the list is also specific to the type of activity (i.e. SIC code) undertaken by the business. For instance, the list of containers for manufacturing businesses may include tankers, whilst they are not included for businesses such as restaurants, since it is unlikely that this type of business will use tankers for waste removal. Using filtered lists ensures that the questioning remains succinct and not confusing for the user. If the interviewee indicates that a company not included in the database removes material from their business, then a generic list is displayed containing a complete list of all containers available. Further information on the frequency and fullness on average when collected of containers and the types of waste materials collected for these main waste removal routes is asked for later.

PLEASE CLICK ON EACH OF YOUR REMOVAL OPTIONS BELOW TO SELECT THE TYPE OF BINS YOU HAVE FOR EACH

**REGULAR WASTE ONLY**

Local Authority **Onyx** central depot Removed by another business Direct - Waste Transfer Station Direct - Landfill Site Donated - Charity, etc. Staff - HWRC

Staff - Recycling bank Staff takes home burnt

Please give details of the type(s) of waste you take to the waste transfer station. This information is given on your [waste transfer note](#) as required by the [Duty of Care Regulations](#) and should be entered below for each type of waste (use a separate box for each).

If you cannot find a waste transfer note, then please provide as much information below as you can instead: the types of waste, what containers (and how many) you use, amount of waste, etc.

Description of waste	Weight	How often do you take this material to the WTS
general process waste	<input type="text" value="1"/> <input checked="" type="radio"/> tonnes <input type="radio"/> kilos	Once per <input type="text" value="Monthly"/>
<input type="text"/>	<input type="text"/> <input type="radio"/> tonnes <input type="radio"/> kilos	Once per <input type="text" value="Daily"/>
<input type="text"/>	<input type="text"/> <input type="radio"/> tonnes <input type="radio"/> kilos	Once per <input type="text" value="Daily"/>
<input type="text"/>	<input type="text"/> <input type="radio"/> tonnes <input type="radio"/> kilos	Once per <input type="text" value="Daily"/>

Is the information given above taken from a Waste Transfer Note?

YES ☐ NO ☐

**Figure 4.6: Example of material taken to waste transfer station details page**

For ‘other’ removal options other than via local authority or private waste/ recyclables/ reprocessing companies, further details are taken at the same time of the type of waste removed in order to provide an estimate of the amounts of the different materials removed by these methods. For the local authority and waste companies routes these details are asked for later. For material sent back to a central depot a limited number of container types is displayed, indicative of the types and volumes of containers used by businesses for backfilling of material. In addition, a description of each material is recorded, plus the number of containers used and the frequency that the material is taken away.

For removal of material by another business, or taken to a waste transfer station or landfill site the questionnaire only gathers information about the description of the material, the weight and frequency that it is removed by the other business (Figure 4.6). In these cases the business should be provided with a Waste Transfer Note (WTN), and should have information about the weight of the material. Therefore, it was felt that it is not necessary to collect information about the container used (volume).

Since it is unlikely that a business will use a standard waste container for material taken to a HWRC, to a recycling bank, taken home or donated to a charity or similar, images of containers indicative of the types and size most likely to be used for such a purpose are given (Figure 4.7). Again, the interviewee can enter a description of the material donated, the number of containers and the frequency of collection; and, if known, the weight of material.

PLEASE CLICK ON EACH OF YOUR REMOVAL OPTIONS BELOW TO SELECT THE TYPE OF BINS YOU HAVE FOR EACH

**REGULAR WASTE ONLY**

Local Authority | Once central depot | Removed by another business | Direct - Waste Transfer Station | Direct - Landfill site | Donated - Charity, etc. | Staff - HWRC

Staff - Recycling Banks | Staff takes home | Burnt

Material is taken to one or more Household Waste Recycling Centres (Civic Amenity sites) by a member of staff

	How many	Description of waste removed	How often is this material taken to the HWRC	per	
 shoe box or similar size volume 0.007m <sup>3</sup>	<input type="text"/>	<input type="text"/>	Once	per	Daily
 carrier bag or similar size volume 0.013m <sup>3</sup>	1	glass jars	Three times	per	Monthly
 supermarket box volume 0.035m <sup>3</sup>	<input type="text"/>	<input type="text"/>	Once	per	Daily

**Figure 4.7: Example of material taken to HWRC details page**

#### 4.1.4. Waste composition section

This section of the questionnaire collects information about the types of material that the business produces on a regular basis and removed by the local authority and private companies, since information has already been collected about the materials removed from the business by other routes. As with other sections the first page is a simple introductory page giving an explanation of the information required by the questionnaire.

This part of the questionnaire has been designed so that the pages that are displayed, although similar in content, are specific to the SIC code of the business, or to a group of SIC codes. The route through the programme taken by the various SIC codes is given in Appendix 6,

together with an example of the flow diagram for the programme. For each SIC code given in Appendix 3 it has been determined whether or not businesses with this SIC code are likely to produce each type of waste, both at the main category and sub-category level. Furthermore, lists of materials found within each sub-category have also been produced for each SIC code.

The questionnaire takes the business through increasing levels of detail in describing the materials in their waste. Starting with identifying the main resource stream categories that they produce and then continue through layers of main categories and further sub-categories associated with this stream (see the resource classification Appendix 1) identifying the material types in as much detail as they are able. Figure 4.8 shows the page that appears if the Food, plants, soil etc (i.e. “organics”) stream is chosen; this gives examples of typical material found within this category of material, together with appropriate pictorial images. At the top of the page are buttons for each of the twelve main material categories used for the questionnaire classification system. Any material that is unlikely to be produced by the particular business (i.e. SIC code specific) is crossed-out with a red line to indicate this fact. However, it is still possible to select the buttons for these materials, in order to allow for the possibility that the business might still produce these materials.

**Figure 4.8: Example of material-specific entry page**

From here they can either go to another resources stream if they decide they don’t produce this material or onto a page where they are given subcategories to choose from. However, if they are not sure which sub-categories of material they produce then these tick-boxes can be left unchecked. In this instance the programme will simply record that the business produces the main material category; otherwise it will record both the main and sub-categories of material. Additionally, the interviewee may leave all tick-boxes unchecked, and the programme will not record anything. To aid with identification of the types of material found within each sub-category, a pop-up ‘INFO’ button is given below each. An example of this information page is given in Figure 4.9.

If the interviewee selected any sub-categories at this stage then on the next set of pages they have the opportunity give more information about the types of material they produce within each of the sub-categories from a page displaying the most likely types of material found within that list heading. These lists have been designed so as to be SIC code specific. The



interviewee can then select the appropriate material(s) from the list and this will be recorded by the programme. Thus, the questionnaire allows the interviewee the flexibility to give as much (or as little) information as they are able to.

Figure 4.9: Example of material sub-category selection and information pages

#### 4.1.5. Bin-filling section

The next stage of the questionnaire is where the interviewee fills up each of the different containers with the different materials that go into each container. Volumes rather than weights are asked for and the questionnaire has an inbuilt database of all densities based on waste type and business, sourced from the Environment Agency (EA, 2004). Containers used can be grouped to save time but to avoid errors only where bins contain material of the same composition. As the interviewee selects the percentage (by volume) of each material that goes into the container, a graph is displayed at the left-hand side of the screen as a visual aid (Figure 4.10). Further pages question the amount of each sub-category of material within each container, before returning to fill additional types of container for that business (the programme flow diagram for this is given in Appendix 7).

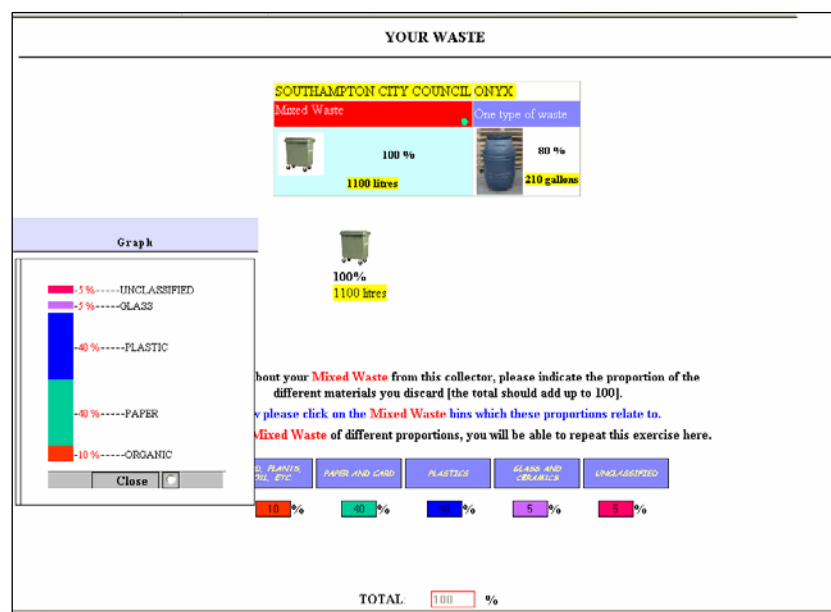


Figure 4.10: Example of bin-filling page



#### 4.1.6. Occasional waste

As mentioned previously, the above sections of the questionnaire were only concerned with material generated on a regular basis. The next section aims to collect information about any material that is produced on an occasional basis that the business has generated within the previous twelve months. This section has been split into two sections, and the interviewee can indicate on the start page whether they have produced any material from the following:

- waste from maintenance and refurbishment activities
- other waste produced occasionally throughout the year

An explanation of the sorts of material generated for each type is given on the page when the interviewee scrolls over the appropriate text (so as to minimise clutter on the page).

The interviewee is asked, for each different maintenance or refurbishment activity, for a description of the material generated by the activity, plus the container used for removal and an estimate of the volume is entered. Additionally, if known, the weight of material can be entered. Then the frequency with which this material is produced is selected: the range for this is from a minimum of once less often than four years, to ten times every year to allow as much flexibility of choice as possible. The interviewee can also indicate whether the material is recycled or not; if they do not know then they can select 'not sure' (Figure 4.11).

PLEASE GIVE DETAILS OF THE DIFFERENT WASTES PRODUCED FROM MAINTENANCE AND REFURBISHMENT ACTIVITIES

You only need to use a separate row for each activity producing waste, not for each type of waste. For instance, a refurbishment would be one activity; leaf clearance another, etc. Also, please give as much description in each box, as this will help us to give a better estimate of the amounts of waste you produce annually.

For a more detailed explanation of what is required for each column, click on the column heading

Description of waste	Container used to remove waste: e.g. hippo bag, skip (if known or relevant)	Estimate of volume of waste	Weight (if known)	How frequently is this waste produced	Is this material recycled?
general refurbishment items	skip	6 cubic yards	tonnes kilos	Once every 4 years	YES NO NOT SURE
			tonnes kilos	Once every year	YES NO NOT SURE
			tonnes kilos	Once every year	YES NO NOT SURE
			tonnes kilos	Once every year	YES NO NOT SURE
			tonnes kilos	Once every year	YES NO NOT SURE
			tonnes kilos	Once every year	YES NO NOT SURE
			tonnes kilos	Once every year	YES NO NOT SURE

**Figure 4.11: Maintenance and refurbishment waste page**

Similar information is collected for any other occasional waste the business may produce, using a drop-down list of different waste types in order to help classify this occasional waste more readily.

#### 4.1.7. Summary of main waste: confirmation and additional information

Following the occasional waste section, the questionnaire now gives a summary of the waste/recyclables produced by the business that is subsequently removed by the local authority and/or private companies.

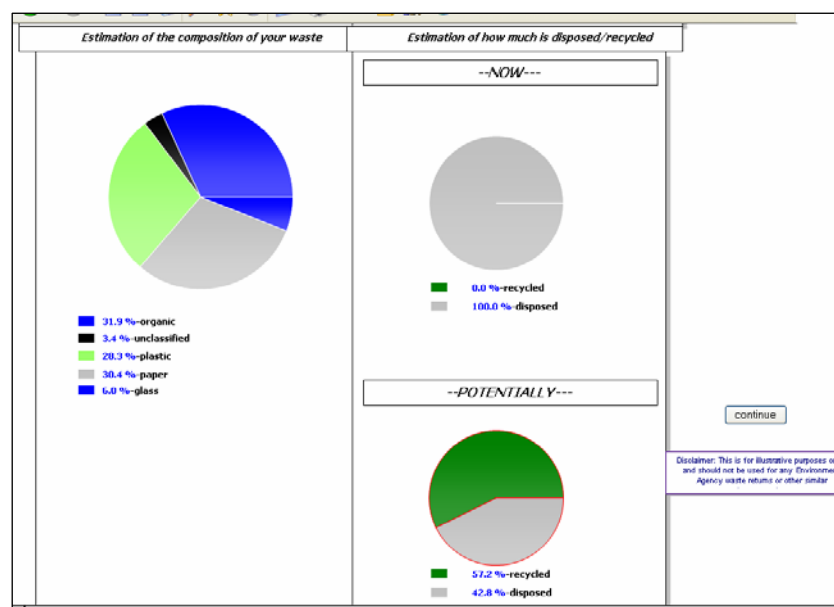
The first summary page lists all the containers for each collector, together with details of the type of waste within each container, its fullness and corresponding volume of material per collection. The list of descriptions displayed according to type of material is given in Appendix 8 in the “description alias” column. This description is used for display purposes only in the questionnaire as a simple way of identifying to the interviewee what’s in each bin.

Appendix 8 shows what these descriptors refer to in relation to the resource classification and the codes used for each sub-category in the classification.

This gives the interviewee the opportunity to check this information and a note can be made if they feel the values are not correct; for instance, they may decide the container is not quite as full as they previously indicated. This information is recorded by the questionnaire, but the programme does not make any adjustments at this stage. Instead, during analysis, the database can be checked to see if any information was logged and any necessary changes made. The summary pages also check whether material is either compacted or ground-up before going into containers so that if necessary a compaction factor can be applied, and to record weights from Waste Transfer Notes or the businesses knowledge of the weight of their wastes.

From the collected information the questionnaire calculates details of the waste composition and percentage recycling rate in order to provide the interviewee with instant feedback (Figure 4.12). This is only for material that is removed by the local authority and/or private waste company, since the programme is presently unable to calculate immediately the amounts of material generated via any other removal options used by the business. When explaining the pie charts, this is indicated to the interviewee, so that they do not misinterpret the data.

The compositional pie chart is the composition by weight, normalised to a monthly material generation. This has been done in order to account for the different collection frequencies with which different materials may be collected from the business. Because the programme does not automatically account for any closure periods for the business, it was decided that normalising to a monthly figure would be better than an annual figure, which can be subsequently determined during analysis of the data.



**Figure 4.12: Summary of feedback waste pie chart**

Also given is the split between material disposed and recycled by the business based on information collected during the questionnaire; and the potential split based on assumptions as to whether each material produced by the business has the potential to be recycled using present methods (see Appendix 8 for designations of recyclability used).

#### 4.1.8. Waste awareness

This section gathers information about how aware the interviewee is with regard to waste regulations, legislation, etc (see Figure 4.13) and logged so that appropriate feedback can be given.

**WASTE AWARENESS**

Can you please tell us a little bit about your waste awareness - this will help us tailor any feedback to you regarding things such as waste legislation and regulations.

Do you know if your waste carriers are registered with the Environment Agency as licensed carriers? Yes - I know that all are

Do you have a copy of these licence(s)? Yes - all of them

Have you ever carried out a waste audit on your business? Once

Do you monitor your waste expenditure? Yes

Do you have an Environmental Management System in place? No

Do you have an Environmental Policy? Yes - informal

Are you aware of or joined any Business Environment Group? No

Are you aware of any legislation or initiatives relating to your business waste? Yes

Which ones? Please select:

- Environmental Protection Act
- Environmental Protection (Duty of Care) Regulations
- Controlled Waste Regulations
- Landfill (England and Wales) Regulations
- Packaging Regulations
- Producer Responsibility Obligations (Packaging Waste) Regulations
- Waste Management Licensing Regulations
- Special Waste Regulations

CONTINUE

**Figure 4.13: Waste awareness page**

For purposes of the survey, it is not only important to understand the waste arising from a business type, but also to gain an understanding of the levels of awareness businesses currently have. If new structures are to be put into place, it is possible that businesses will need to be made more aware of the issues involved and the need for appropriate management. Questions were targeted to understand if businesses really understood as to what their legal obligations were. Asking about licences rather than waste transfer notes enabled the user to think more about the reasons why a transfer note is required, and feedback on this important aspect to be given. Housekeeping issues such as waste expenditure and auditing follow to assess current activity and if there is an understanding of the linkages between the two. Enquiring about Business Environment Groups links into the housekeeping questioning as an assessment of their current status and potential development may be made. The section ends by asking about legislation or initiatives, if they are aware of any rather than fully conversant. One of the options given was 'Special Waste Regulations' – old legislation, but was included to assess how many businesses were actually aware of this. The correct answer is given in the feedback to alleviate any misconceptions.

#### 4.1.9. Comments, thank you and feedback request pages

The questionnaire is completed with an opportunity to give any additional information and comments about the questionnaire or aspects of their waste management. In particular, they are encouraged to give their thoughts on any improvements that could be made in order to enhance the service they receive by their waste/recyclables collectors; or to provide details of any perceived barriers they feel exist that prevents them from recycling (more of) their waste. This page is a useful addition to the main questionnaire as it serves to allow the user to write about the issues that will have been thought about during the questionnaire process in

addition to other issues. This ensures the process ends with a degree of ownership for the user, and as a stakeholder in business waste issues, ensures that their views are reported.

The final page of the questionnaire thanks the interviewee for their participation and asks them if wish to receive tailored feedback information giving details of local waste/recycling companies that might be of use to them. Feedback is primarily based on business location, type of business and secondary activities, waste produced and discarded to mixed waste bins, and best practice and legislation. A letter accompanying the feedback information briefly explains the information enclosed:

*'Enclosed is a summary of the results obtained for your business, which gives an indication of the amount of waste your business generates annually, and how much of this you recycle at present. As requested, we have also included some information that we feel would be of interest to you. This includes details of your local Business Environment Group and Environment Agency office, and Envirowise (assists businesses with environmental matters). These organizations can provide you with practical advice and assistance about how best to deal with your waste; legislation that may affect your business; and other environmental advice. We have also sent you some details of the legislation and regulations most relevant for your business; and details of recycling companies in the area that may help you to manage your waste more cost-effectively, particularly with regard to resource recovery.'*

Leaflets and handouts might include some of the following:

**BRAS**  
The Centre for Business Relationships  
Accountability, Sustainability & Society

**CARDIFF UNIVERSITY**  
WELSH SCHOOL OF  
CARDIFF

**the Environment Centre (tEC)**  
you · your business · your community

**Worried about costs?**

Are your profits going in the bin, down the drain or up the chimney?

**NetRegs**  
Guiding small businesses through environmental regulations

**LOCAL RECYCLING COMPANIES**

**Fluorescent Lights & Tubes:**  
Bakersfield Environmental Services Ltd  
Biffa Waste Services  
B.K.P. Environmental Services Ltd  
Cleansway Ltd  
Cleansing Service Group Limited  
Solwaste Environmental Ltd  
The Lump Recycling Company Ltd

**Food (Cooking Oils & Fats):**  
A & B Oil  
B.K.P. Environmental Services Ltd  
Cleansway Ltd

**waste – can you handle it?**  
New rules on business waste

This introductory guide is aimed at business managers with limited experience in managing waste. It is an introduction to the new rules, what they mean and what you

**OVERALL COMPOSITION OF MATERIAL THAT LEAVES YOUR PREMISE**  
(note: any materials less than one percent are not shown on the pie chart)

Material	Percentage
Unsorted	36%
Organics	23%
Paper/card	30%
Plastics	9%
Glass	2%

**HOW MUCH IS DISPOSED / RECYCLED?**

**PRESENTLY:**

Category	Percentage
recycled	3.1%
disposed	96.9%

**POTENTIALLY:**

Category	Percentage
recycled	27%
disposed	73%

NOTE: The information presented here is for illustrative purposes only, and should not be used for any Environment Agency waste returns or other similar documentation

## 4.2. Reflections on use of questionnaire

The questionnaire was first tested internally and then piloted with 26 SMEs across the range of food sector businesses being targeted. This testing highlighted a number of problems related to smooth delivery of the questionnaire such as broken linkages between pages and these were improved before the full survey was undertaken. Other issues that arose during the piloting included:

- Need for clear and unambiguous language. Some words and phrases caused confusion, such as the use of 'organic' to mean waste of a biological nature such as food or soils. Some interviewees interpreted this as the popular definition of 'grown without chemicals'. Information buttons for all terms used throughout the waste section, and explanation from the interviewer alleviated this problem.
- Judgement of bin receptacle size was difficult from the images given, even though sizes were described. No easy solution was found for this except to rely on the interviewer to assist in interpreting the information.
- The individual waste pages became laborious for some interviewees where a business had a wide ranging waste stream. This could lead to confusion and as a result interviewers needed to be more vigilant with these pages.

The questionnaire was designed to take around 20-30 minutes to complete, and did so in just over half of the businesses interviewed. The range was 9-88minutes. The main reason for taking longer than the ideal time was interruptions during the process, such as the need to serve customers or take telephone calls. Some interviewees engaged in general chat with the surveyor surrounding a waste issue and this also lengthened the process. The questionnaire was able to cope with periods of inactivity to allow the interviewee to carry on with business if needed, but as it did not have a pause button this additional time was recorded as part of the process.

## **5. Hampshire case study – survey design**

The questionnaire was tested through an audit of C&I waste in the food and food-related business sector in Hampshire. This survey of SMEs was designed to meet two main project research aims. The first was to test the methodology, both in the usability of the questionnaire and the level of detail it obtains in assessing waste arisings from SMEs, particularly those smaller businesses where there is a paucity of accurate data. The second was to carry out a case study to provide rigorous data on the resource potential of this waste stream from food sector SMEs in Hampshire, and the information gathered can be used to generate a profile and resource map of C&I waste resources.

Data from the audit can be compared and combined with data on household or municipal solid waste, and used to identify from the existing infrastructure within Hampshire, potential gains from a comprehensive integrated approach to management of municipal and C&I waste, particularly for improved recycling activity. In addition the audit was devised as a tool for businesses in maximising this potential by providing feedback on their waste streams and opportunities for increasing recovery.

Before the survey could be undertaken a robust sampling strategy was needed to ensure statistical reliability. This required determining both the business profile for the county and a suitable sampling framework. The overall profile of SMEs in Hampshire by SIC 2003 codes and size was identified, and an initial classification devised which offered compatibility with the EA 1999 survey groupings and had 27 main SIC code grouping classifications for the 40,000 SMEs in Hampshire. However it was concluded that a survey far bigger than was possible within the resources of this project would be needed to generate reliable results for this wide range of businesses. In order to achieve the main aim of this project of developing a robust methodology, it was necessary to focus on a particular business sector for the case study. After discussions with the project's Advisory Panel it was decided to focus of the survey for the case study on SMEs engaged in food and drink related activities. This provided a more focused, but still extremely diverse group of businesses, where we could potentially drill down into more detailed SIC groups.

The approach taken to developing the sampling strategy for the survey involved:

- establishing the business profile for SMEs in the food and drink related sector in Hampshire;
- establishing a sampling matrix based on SIC codes and size of business;
- developing a database of businesses from which the sample for the survey can be drawn.

### **5.1. Business profile for SMEs in the food and drink related sector in Hampshire**

The profile was determined based on the Standard Industrial Classification (SIC) code and size classification for each business. The industry classification used for the project was developed from the SIC 2003 system. The case study focused on the food-related industries, which can be grouped as manufacturing, wholesale and retail and hospitality, and the categories which can be identified within the SIC 2003 code system as shown in Table 5.1.

• Food & Drink Manufacturing (15)	• Hotels (55.1)
• Food & Drink Wholesale (51.3)	• Guest Houses & Campsites (55.2)
• Food & Drink Retail (non-specialist) (52.1)	• Restaurants, Cafes & Takeaways (55.3)
• Food & Drink Retail (specialist) (52.2)	• Pubs, Clubs & Bars (55.4)
	• Canteens & Caterers (55.5)

**Table 5.1: Main SIC 2003 groups for food-related businesses**

The size bands used for the classification were: micro (2-9 employees); small (10-49); and medium (50-249). These were based on numbers of employees rather than business turnover in the same way as the EA surveys. This definition is also used by the Department of Trade and Industry and the EU Commission (see <http://www.sbs.gov.uk> and [http://ec.europa.eu/enterprise/enterprise\\_policy](http://ec.europa.eu/enterprise/enterprise_policy) ).

Each of these SIC codes represents a broad range of businesses and often groups together businesses with very different activities. Further detailed levels of classification take the SIC codes beyond the 2 or 3 digit level to give further sub-divisions to 4 or 5 digit levels. The full classification (see Appendix 3) shows considerable variation of business activity within groups. At the 5 digit level it has 86 groups of businesses, and at the 4 digit level 59 groups. The survey focused on the 9 groups in Table 5.1, recognising that some groups cover a wide range of business activities which may generate different wastes.

Although the audit only surveyed a sample of the total population of businesses, the whole population needs to be known in order to generate estimates of total waste arisings for Hampshire through the so-called 'grossing –up' of the results from the survey. The ONS (Office of National Statistics) hold the most comprehensive data on businesses by SIC code, size and location and provided counts of local units of SMEs in Hampshire in the SIC 2003 code groups and size bands we were considering, as shown in Table 5.2.

There are around 4800 SMEs in the food and drink related business sector in Hampshire, and of these 62% are micro; 33% small and 5% medium-sized. Restaurants and bars account for almost half the businesses, with retail nearly 30%.

SIC code category	Business count within each size band			
	2-9	10-49	50-249	Total
Food & drink manufacturing (15)	70	40	15	125
Food & drink wholesale (51.3)	120	65	20	205
Food & drink retail (52.1+52.2)	835	485	95	1,415
Hotels (55.1)	65	85	45	195
Guest house & campsites (55.2)	50	10	5	65
Restaurants, cafes & takeaways (55.3)	805	280	45	1,130
Pubs, clubs & bars (55.4)	780	465	5	1,250
Canteens & caterers (55.5)	300	160	20	480
<b>Total</b>	<b>3,025</b>	<b>1,590</b>	<b>250</b>	<b>4,865</b>

**Table 5.2: ONS counts of food-related businesses within Hampshire**



## 5.2. Sampling matrix for survey

In order to ensure that the sampling and analysis will produce statistically viable results, sufficient numbers of businesses must be surveyed within each SIC code grouping and size band. Starting with the 9 SIC code groups, and 3 size bands – i.e. micro (2-9employees); small (10-49 employees) and medium (50-249 employees) we looked at how many businesses we would need to sample in each cell (of the 27 in total) to provide a statistically reliable result.

Evidence from the EA 1999 survey of C&I wastes was that data variations were likely to be large within each group. The EA 1999 C&I survey found a huge variation in waste arisings within some of the SIC code groupings sampled, and a very wide range in the variability of data from group to group. Knowing that our results were likely to provide very ‘messy’ data, a staged approach to determining the numbers of businesses needed to be surveyed was pursued. Firstly, after discussions with, and commissioning work by Julian Ellis (statistical advisor to the EA on both the 1999 and 2002/3 EA C&I surveys), an approach to minimising relative standard errors through varying the sample sizes for different cells was explored. This used variances in the EA 1999 survey data to inform our sampling using a statistical planning program COOP (‘Calculation Of Optimal Precision’) reconfigured to meet the specific SIC code groups and size bands of this project. This would allow us to predict where the most variable sectors were likely to be and hence sample more of these businesses in order to hopefully improve the accuracy of the results, whilst sampling fewer of the businesses whose waste arisings proved more consistent across the sample.

A number of analyses were carried out to work out the optimum distribution of samples to achieve the best overall predicted accuracy for different overall sample sizes and minimums for each cell. Table 5.3 shows the results for both an overall sample of 250, with a minimum of 2 in each cell and for a larger sample of 500 with a minimum of 8 per cell.

Sample size 500 / min 8 per cell				Sample size 250 / min 2 per cell			
SIC code	Employee Sizeband			SIC code	Employee Sizeband		
	2 - 9	10 - 49	50 - 249		2 - 9	10 - 49	50 - 249
15	8	40	15	15	4	40	15
51.3	8	13	20	51.3	2	5	8
52.1	10	61	90	52.1	6	34	50
52.2	18	9	5	52.2	4	2	2
55.1	8	11	19	55.1	2	4	7
55.2	8	8	5				
55.3	15	24	14	55.3	9	18	8
55.4	11	31	5	55.4	6	18	2
55.5	8	22	14	55.5	2	6	4

**Table 5.3: Possible sampling framework to optimise precision**

The larger sample predicts an overall precision of +/- 6.9% at CI 90%; with a range for the individual SIC code groups of between +/- 6% and 31%. The smaller sample size is less precise with an overall predicted precision of +/- 11.4% at CI 90%; with a range for the individual SIC code groups now of between +/-9% and 69%. These levels of confidence are comparable to those achieved in the EA 1999 survey, although the greater sample size of the latter resulted in an overall great precision of the full survey.



Due to extremely high variability in some cells of the EA data, some sample sizes are unrealistically high and either approaching or equalling the population size for that cell for Hampshire, as comparison between Tables 5.2 and 5.3 shows. Clearly it is unrealistic to survey the whole population in that they are unlikely to all be willing to participate in the survey, and this had to be accounted for by adjustments to the matrix.

the minimum from each cell was set at five. Secondly

This optimum sampling framework primarily provided an indication of where the most uncertain data is likely to be found and hence highlighting where additional sampling could improve results. Due to practicalities in recruiting the survey sample, particularly where large numbers approaching the population size were suggested, a compromise sampling matrix was then adopted. This was based on setting a minimum number of businesses to be surveyed of 5 per cell, set between the minimums for the two frameworks described above. However it was designed to also take some account of population sizes and the variance in EA survey data by increasing this to 8 or 10 where the variance was greater. This was used as part of an iterative approach to survey sampling that proposed adjusting sample sizes based on ongoing measurement of variance and precision as the survey progressed. The sampling matrix used to recruit the initial survey sample is shown in Table 5.4:

Group	Business type	SIC	Micro	Small	Medium	Total
1	Food and drink manufacturing	15	5	10	10	25
2	Food and drink wholesale	51.3	5	5	8	18
3	Non-specialist food and drink retail	52.1	5	10	10	25
4	Specialist food and drink retail	52.2	5	5	5	15
5	Hotels	55.1	5	5	5	15
6	Guest houses and campsites	55.2	5	5	5	15
7	Restaurants	55.3	8	8	8	24
8	Pubs, clubs and bars	55.4	5	10	5	20
9	Catering and canteens	55.5	5	5	5	15
					<b>total</b>	<b>172</b>

**Table 5.4: Proposed sampling framework**

### **5.3. Business database of SMEs in the food-related sector in Hampshire**

Having identified the sampling framework, individual business identities were needed to recruit a sample of SMEs for carrying out the survey. As ONS aren't able to disclose business identities to non-government bodies, the next step involved generating a database of businesses from which the sample can be chosen.

This database of businesses – names, addresses, SIC code, description of business activity, and number of employees for the SIC groups covered in the audit – was compiled by searching under multiple criteria using a number of sources including the Companies House database FAME (Financial Analysis Made Easy), the Hampshire Business Directory and Yellow Pages or Yell.com. The data acquired from each source was cross-checked against the others for completeness and duplication.

The numbers of businesses in the database compiled by the project is shown in Table 5.5. This compared very closely to the ONS count of 4,865 (see Table 6.1 for the full ONS data) which implies that the database is reasonably comprehensive, and hence closely matching the

population. There are bound to be inaccuracies and omissions from both the project database and the ONS counts but these were minimised as much as possible.

Business size information was not available in 78% cases from the database sources used, and had to be established as businesses were being recruited for the survey.

<b>Business type</b>	<b>SIC code</b>	<b>micro</b>	<b>small</b>	<b>medium</b>	<b>size unknown</b>	<b>total</b>
Food and drink manufacturing	15	11	14	21	129	175
Food and drink wholesale	51.3	12	38	16	240	306
Non-specialist food and drink retail	52.1	22	12	2	682	718
Specialist food and drink retail	52.2	77	22	0	582	681
Hotels	55.1	49	54	28	216	347
Guest houses and campsites	55.2	7	5	3	74	89
Restaurants	55.3	113	56	5	827	1,001
Pubs, clubs and bars	55.4	263	124	1	825	1,213
Catering and canteens	55.5	35	11	3	349	398
					<b>total</b>	<b>4,928</b>

**Table 5.5: Profile of business database compiled by the project**

#### **5.4. Waste audit survey sample**

The approach to identifying individual businesses for sampling that was considered most appropriate for this survey was to use a stratified random sample to provide the required number of businesses for each cell and to be representative of different business types and sizes. This requires a random sample to be selected from each group and surveyed to provide data on the typical waste arisings for that type and size of business, and from which the resources available from the waste stream of SMEs in Hampshire can be statistically extrapolated. The importance of the sampling framework is to ensure when comparing groups of businesses that the differences between them are significant and due to differences between the business types and sizes not due to variations in the data due to errors introduced through sampling.

All businesses on the database were sent flyers and an invitation to take part in the survey. This was followed up by telephone calls to the selected stratified random sample of businesses. However the resulting low response rate from business approached to take part resulted in the initial stratified random sample failing to recruit sufficient businesses for the survey. Stratified random sampling is often modified in practice to account for both information and practical limitations. Practicalities such as geographical location and travelling times may suggest limiting the locations from which the sample is drawn. This situation where non-response and missing cases is high, quota sampling was deemed the most appropriate approach.

With quota sampling, a quota is set for each sample and these are then filled as interviews are set up. Quota samples can introduce bias and distort the population by variables which were not included in the quota and ignoring a particular sub-set or group. The quotas used matched the requirements of the stratified sampling framework and set to fit the population profile. In this way those recruiting businesses to be surveyed attempted to fill the profile set out in Table 5.4.

Unfortunately even with the quota approach it proved very difficult to recruit sufficient businesses in some size bands and activity types to complete the sampling framework. Most difficulty was experienced amongst the medium and small businesses, and as a consequence it was decided to recruit larger numbers of micro businesses to compensate for low overall numbers. The final survey sample as carried out is shown in Table 5.6.

Group	Business type	SIC code	micro	small	medium	total
1	Food & drink manufacturing	15	4	4	2	10
2	Food & drink wholesale	51.3	7	2	4	13
3	Non-specialist food & drink retail	52.1	22	7	7	36
4	Specialist food & drink retail	52.2	17	2	0	19
5	Hotels	55.1	5	6	3	14
6	Guest houses	55.2	4	0	0	4
7	Restaurants	55.3	12	13	1	26
8	Pubs, clubs and bars	55.4	18	7	0	25
9	Catering and canteens	55.5	3	1	0	4
	<b>totals</b>		<b>92</b>	<b>42</b>	<b>17</b>	<b>151</b>

**Table 5.6: Actual survey sample**

This table shows that a significant number of the cells to contain inadequate samples; 10 cells contain only 2 businesses or less, and 16 have under the minimum number of 5. This presented some issues about the analysis, particularly in relation to providing sufficiently statistically accurate data for the Hampshire audit. This was overcome through some grouping of data as explained in detail in Chapter 6. The survey sample though was of sufficient size and variety to rigorously test the methodology in relation to the questionnaire design and ability to interrogate waste arisings data from this sector.

## **5.5. Waste sampling**

This aspect of the research was sub-contracted to The Environment Centre (tEC) in Southampton. It was designed to offer some degree of triangulation of the results from the survey. Businesses who took part in the survey were asked if they would be willing to have a weeks waste analysed, and a small subset of those who agreed from the retail, hotel, restaurant and pubs & bars sectors was selected at random. They were provided with alternative containers and arrangements made by tEC to collect their waste arisings from one week – this was the waste usually collected by their main waste contractor. This waste was then taken to the Alton MRF Waste Analysis Facility where it was sorted into the compositional categories used in the questionnaire.

## **6. Survey Analysis and Results**

### **6.1. Survey analysis**

A waste audit survey of 170 businesses was carried out by face-to-face interviews using the 'smart' interactive questionnaire and sampled across the nine business types and 3 size groups from the database of over 5000 SMEs, and yielding 151 usable samples. Emphasis was placed on the micro and small businesses as these are where least information is available, and whose wastes are most likely to resemble household waste. The results were analysed primarily in relation to the specific SIC code groups, exploring the accuracy of assumptions about average or typical waste arisings for these business types. This testing of the questionnaire approach to validate its usefulness in collecting accurate data from individual businesses is an important part of the project aims. From this data and information about the business profile, the resources generated by these sectors across Hampshire can be estimated, and comparisons drawn with household waste arisings in the county. This analysis is described in Chapter 8.

Many interviewees narrowly focused their concept of waste on one route, usually the main disposal bins that the company used. The exploratory nature of the questionnaire in asking about wastes in several different ways was thus found to be extremely useful as it often picked up other materials that were remembered or only considered as waste during the course of the interview.

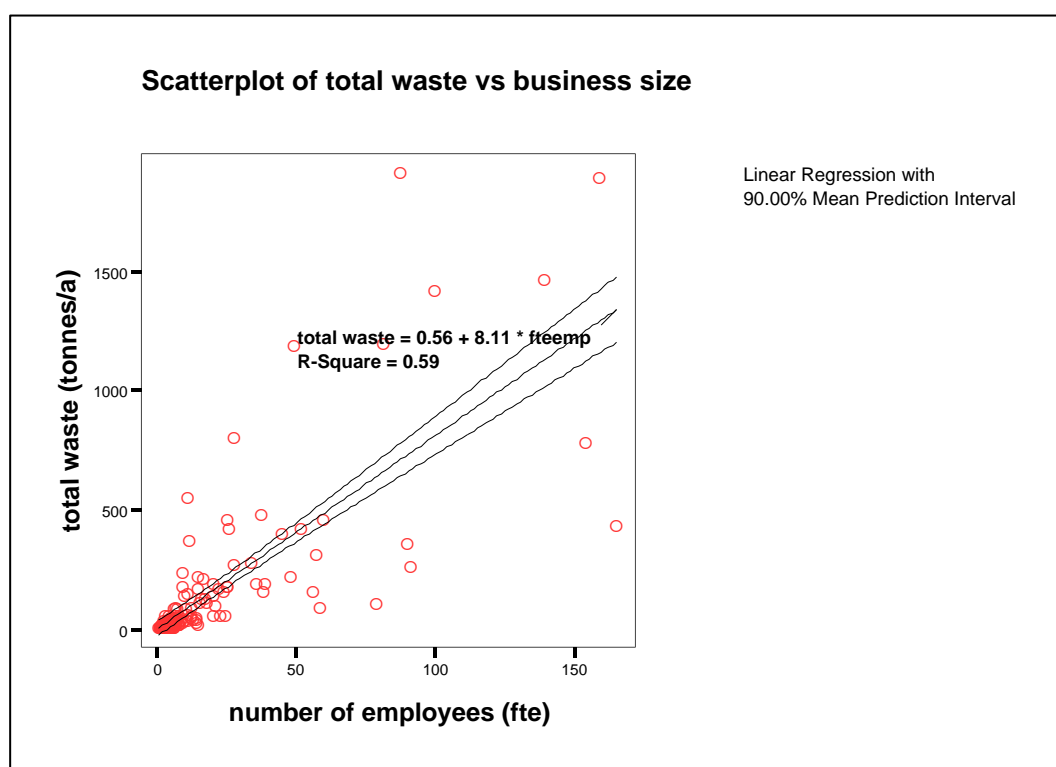
Data was cleaned by identifying gross outliers in the results and considering by close examination whether these represent reasonable but outlying cases or whether there were issues that meant that these should be excluded from the analysis. In this way the four cases of camping /caravan parks were excluded as these produced such highly variable data including in one case waste from disposing of old caravans. This meant that the results for this SIC code group were exclusively for guest houses and other short stay accommodation, not including campsites. Other cases were excluded where results appeared inconsistent or where the main business activity did not fit the SIC code group. In this way we felt the results were not distorted by these extreme outliers even though this reduced the number of cases analysed by a small percentage.

The key data collected (as described in Chapter 4 detailing the questionnaire design) was type and size of company (number of full-time equivalent employees), waste arisings and composition, whether recycled or disposed and by what route.

Individual results for each business, and the average or mean values for each business type were calculated. Where there was a sufficiently large sample, groups were analysed to give statistical measures for average values and confidence for each business type and size band individually. However, as Chapter 5.4 explains, more than half of the cells had samples that were too small to provide statistically valid results at this level of analysis, and consequently the data was aggregated across the size bands to analyse the data by SIC code (type) only and not by size band. This still leaves groups 6 and 9 with relatively small samples, although for some aspects of the analysis these can be amalgamated with groups 5, 7 and 8 to provide results for the hospitality sector as a whole and improve statistical reliability (see Table 5.6 for group numbers).

Simply averaging waste arisings across these size bands is not an appropriate approach because the different sizes of the businesses produce an extremely wide range of waste arisings, and the numbers of businesses surveyed in each size band are not representative of

the numbers in the population. The approach taken to aggregating size bands to create larger samples was to use waste per employee data for each business. Validity of this approach is supported by the strong correlation that exists between business sizes and waste per employee. Since neither data set was normally distributed, Spearman's rho correlation coefficient was used to test the correlation between number of employees (fte) and amount of waste produced. Significant correlation were found at the levels of the whole sample and for the three main business type groups (0.865 for all samples; 0.815 for manufacturing; 0.856 for wholesale and retail and 0.874 for hospitality). It was therefore concluded that aggregating samples across the size bands and working with waste/employee was an appropriate analysis approach. The linearity of the relationship was also tested and showing a linear relationship between them with a reasonably good fit ( $R^2$  0.59).



**Figure 6.1: Scatterplot of total waste vs. business size**

Average waste/employee for businesses in a specific SIC code group provided comparisons between the different business types. This analysis was also used to explore the typical composition of resources in the waste stream from each SIC code group, what routes are used for collection, disposal and recycling and the amount of recycling activity each engages in.

Statistical analysis focused on mean values and calculated the standard deviations, standard errors and 90% confidence interval values. These provided checks on the variability of the data and statistic robustness of the estimates. They were also compared to data from the EA 1999 and 2002/3 surveys where suitable data exists.

When comparing waste arisings across the different groups rather than considering each business type independently it is more informative to weight the data in relation to the relative size of each business type sector within the population as a whole. Since the audit was carried out in Hampshire it was decided to weight the sectors according to the numbers of businesses of each type in Hampshire, as shown in Table 6.1. Where this weighting was applied the result clearly state that this is the case. As the Table shows, restaurants and bars make up nearly half of the food-related SMEs in Hampshire and will consequently be

responsible for creating more waste relative to smaller sectors. However this approximate weighting does not account for different proportions of businesses in the three size bands and the effect that this has on total waste produced by each business type. This aspect of the analysis is accounted for in the full audit data in Chapter 8 where the survey results are grossed-up to give estimated values for Hampshire.

Business type (SIC code groups)	Size bands (number of employees)				% of total for each business type
	2 - 9	10 - 49	50 - 249	Total	
Food & drink manufacturing (15)	70	40	15	125	3%
Food & drink wholesale (51.3)	120	65	20	205	4%
Non-specialist food & drink retail (52.1)	395	440	90	925	19%
Specialist food & drink retail (52.2)	440	45	5	490	10%
Hotels (55.1)	65	85	45	195	4%
Guest Houses and campsites (55.2)	50	10	5	65	1%
Restaurants (55.3)	805	280	45	1,130	23%
Pubs, clubs & bars (55.4)	780	465	5	1,250	26%
Catering & canteens (55.5)	300	160	20	480	10%
total	3,025	1,590	250	4,865	
% of total for each size band	62%	33%	5%		

**Table 6.1: Number of businesses in Hampshire in each SIC code group and size band (from ONS counts)**

## 6.2. Survey results for SMEs in the main food-related business sectors

A strong correlation was found between business sizes and total waste produced which allowed waste per employee to be used to define average or typical waste produced by each business type. This meant that size bands could be aggregated to create larger samples of each business type from the survey data and improve statistical reliability.

### 6.2.1. Average waste arisings for each business type

The overall average waste arisings per employee for the main business types covered by the survey are shown in Table 6.2. As can be seen from both Table 6.2 and Figure 6.2 the manufacturing sector produces the highest waste/employee, and hence per business for SMEs in the same size band. The next highest waste producing sector is non-specialist food retail which includes supermarkets and convenience stores.

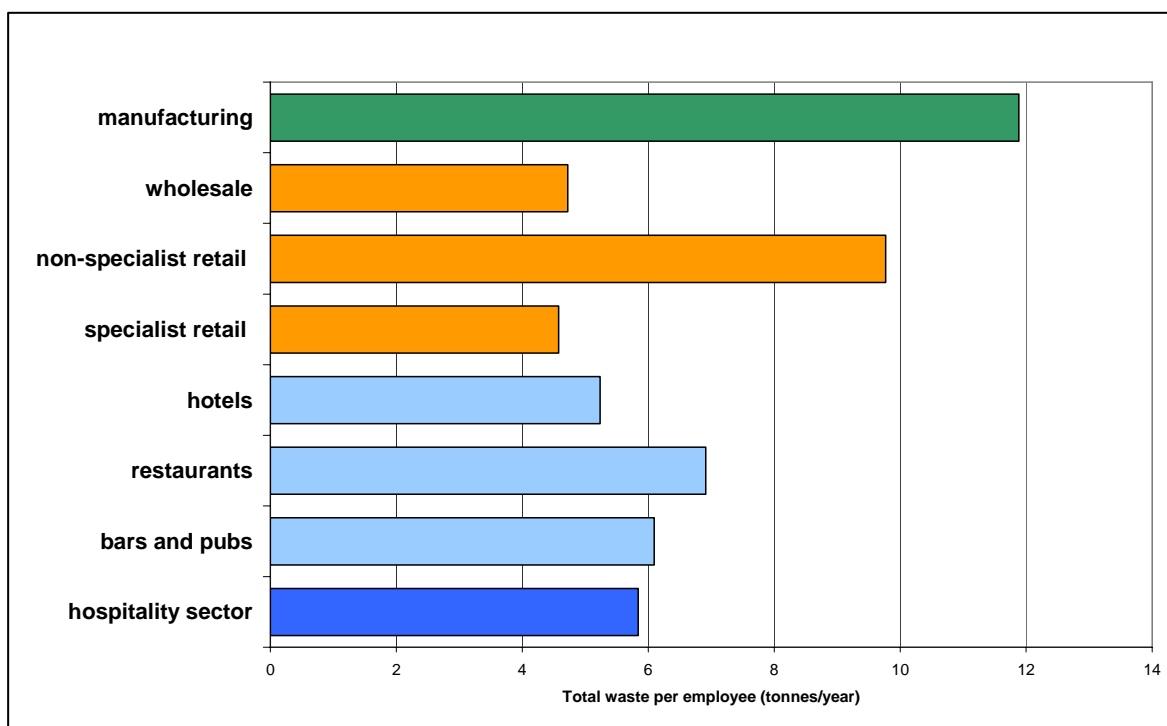
Although many of these businesses are part of larger ‘chains’ and hence not strictly SMEs in ownership, in terms of waste produced per operating unit they have been included where an individual shop employs less than 250 people and hence operates at the SME scale. Those supermarkets that are part of the major chains though do present some anomalies, particularly as will be seen later in terms of recycling activity and use of ‘backfill’ or return loads to central depots.

*In the following tables and the subsequent results the SIC code groups of business type descriptors will be abbreviated to manufacturing, wholesale, non-specialist retail, specialist retail, hotels, guest houses, restaurants, bars & pubs and canteens.*

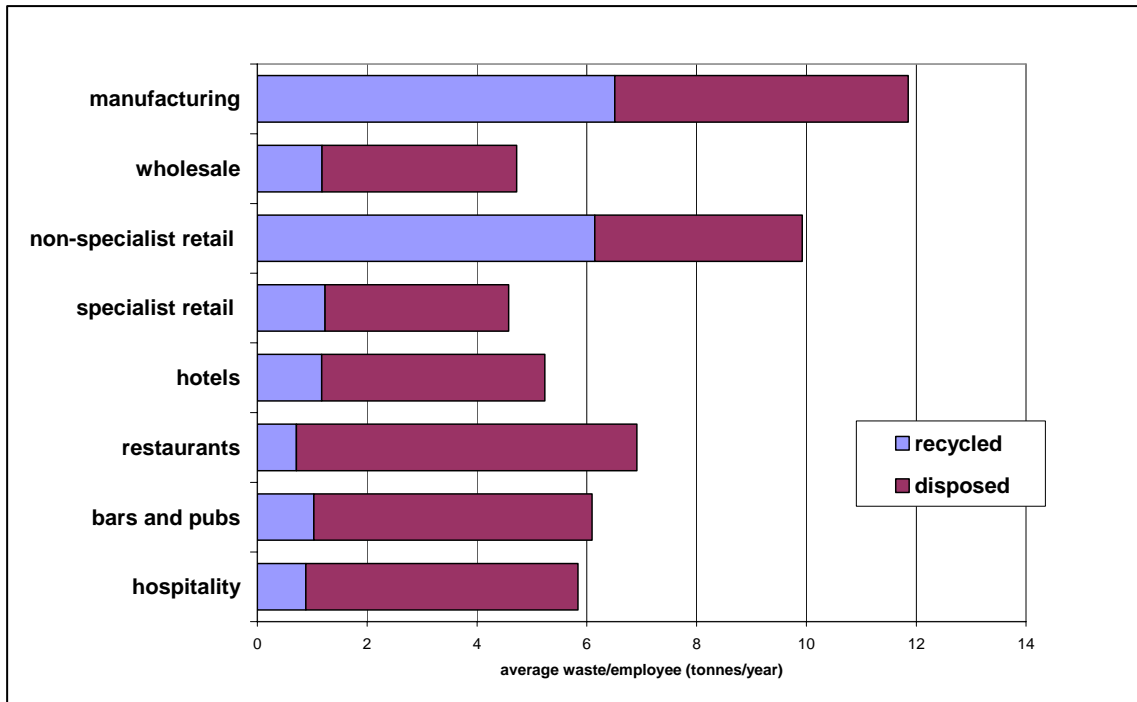
business type	SIC code group	waste per employee (tonnes/year)
Manufacturing	15	11.88
Wholesale	51.3	4.72
Non specialist retail (e.g. supermarkets and convenience stores)	52.1	9.77
Specialist retail (e.g. bakers, greengrocers and butchers)	52.2	4.58
Hotels	55.1	5.23
Guest houses	55.2	2.32
Restaurants	55.3	6.91
Bars and pubs	55.4	6.10
Catering	55.5	2.89
Hospitality sector	55	5.83

**Table 6.2: Average waste arising by business type**

NOTE: data for guest houses and catering are less statistically robust as they are derived from smaller samples



**Figure 6.2: Comparison of total waste/employee by business type**



**Figure 6.3: Waste recycled and disposed for each business type group**

#### Variance in data:

The average values for waste/employee for each business type and subsequent analyses need to be evaluated in relation not only to the calculated mean but also to consider the variance in the results achieved. Measures for standard deviation, standard error and the 90% confidence interval were calculated and presented in Table 6.3 and graphically in Figures 6.4 and 6.5.

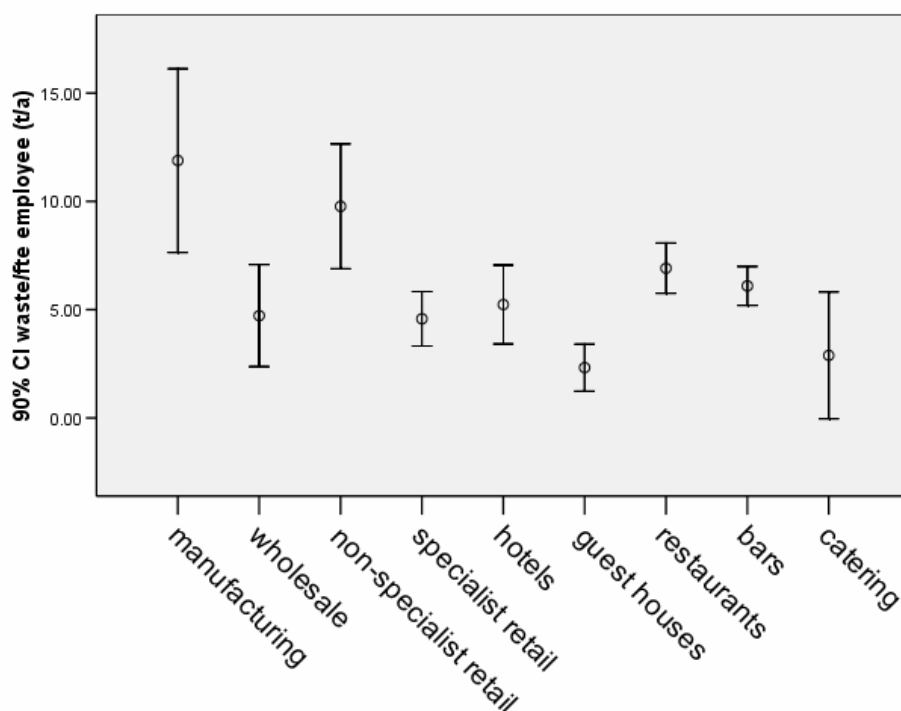
business type	mean waste/employee (t/a)	90% CI (+/-)	SE	std dev
manufacturing	11.88	4.24	2.31	7.32
wholesale	4.72	2.35	1.32	4.76
retail (non specialist)	9.77	2.88	1.71	10.24
retail (specialist)	4.58	1.26	0.73	3.16
hotels	5.23	1.82	1.03	3.84
restaurants	6.91	1.16	0.68	3.46
bars and pubs	6.10	0.90	0.53	2.63
hospitality	5.83	0.65	0.39	3.35

**Table 6.3: Statistical analysis values for waste/employee for each business type**





**Figure 6.4: Mean values with error bars for waste/employee for 3 main business types**



**Figure 6.5: Mean values with error bars for waste/employee for 9 business type groups**

As the data was primarily analysed using waste/employee rather than waste/business it is not straightforward drawing direct comparisons with either the EA 1999 or 2002/3 survey data. Some detailed statistical data was obtained from the 1999 survey and some comparisons made between the standard deviations, standard errors and confidence intervals and those for business types and sizes where sufficient data allowed from the Hampshire survey, which was primarily for the micro sizeband. Table 6.4 shows that although the EA data has relatively higher standard deviations in the mean waste/company, the larger samples in that

survey resulted in greater calculated relative precision at the 90% confidence level. However it should be noted that the errors present in the analysis of the Hampshire survey for waste/business are in the main part higher than when the data is analysed for waste/employee. Also the average amount recorded in the Hampshire survey may be higher due to the emphasis placed in the questionnaire on capturing all waste and recyclable material including that sent by other routes which may not have been explicitly captured in what the businesses classed as waste in the EA survey. Considerable quantities are recycled via the backfill route by non-specialist retail SMEs, and the amount of waste generated without the backfill material included is also included in the table for comparison. This shows a much closer match to the values recorded in the EA survey.

business type	average waste/business for micro size band (tonnes/a)					
	Hampshire survey data			EA 99 survey data		
	mean	90% CI +/-	std dev	mean	90% CI +/-	std dev
Non-specialist retail	43	21	59	21	5	29
– without backfill	25	7	25			
Specialist retail	16	5	11	17	3	18
Restaurants	26	5	10	17	4	22
Bars and pubs	27	5	13	15	2	16

**Table 6.4: Comparison of statistical data from Hampshire and EA 99 surveys**

### 6.2.2. Waste composition for each business type

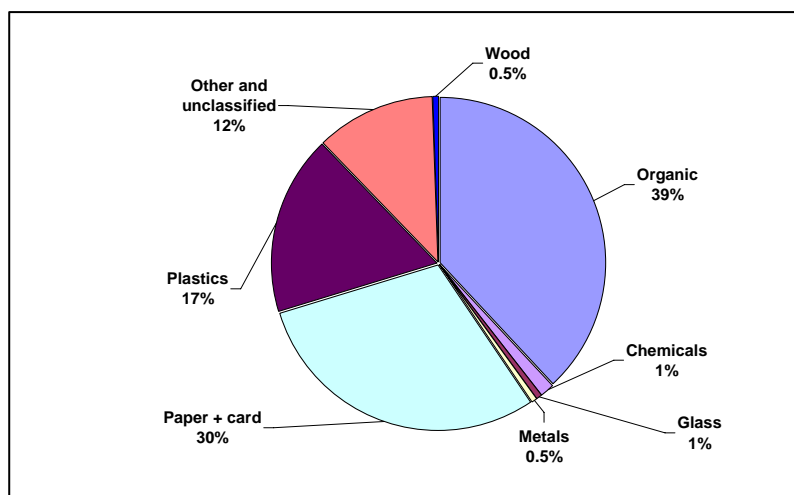
The composition of waste produced varies between the business types as might be expected. The key compositional factors are:

- main components are organics and paper + card; followed by plastics and glass;
- manufacturing produces the highest proportion of organic waste; followed by wholesalers;
- supermarkets and general stores produce the highest proportion of paper + card at 71%;
- the hospitality sector as a whole produces the most glass – with pubs and bars having the highest proportion at 44%.

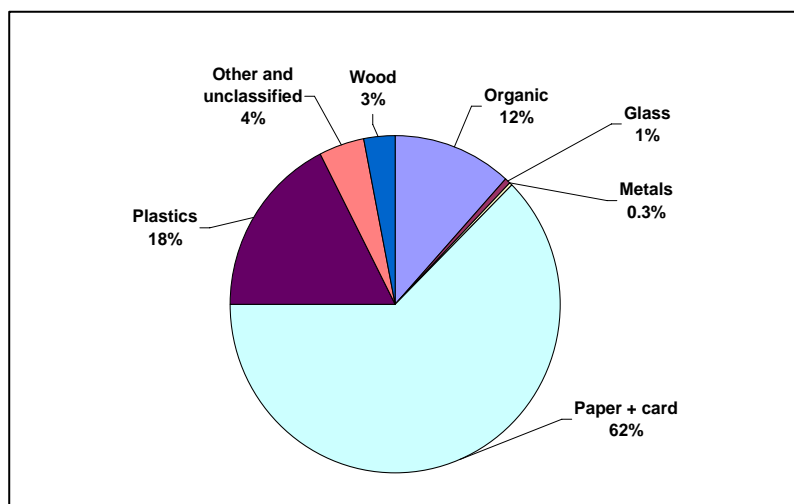
Businesses can be aggregated into 3 groups – which are manufacturing; wholesale and retail, and hospitality. Figures 6.6, 6.7 and 6.8 show the estimated average composition for each group (in relation to relative size of each sector within the groupings).

The organic fraction of waste is predominantly food waste in all types of food related businesses – ranging from 81% in bars and pubs to 100% in the restaurant and manufacturing sectors. Other organics such as parks and garden waste and soils are higher in the bar and pub sector, hotel and specialist retail sectors but are generally small fractions of waste produced.

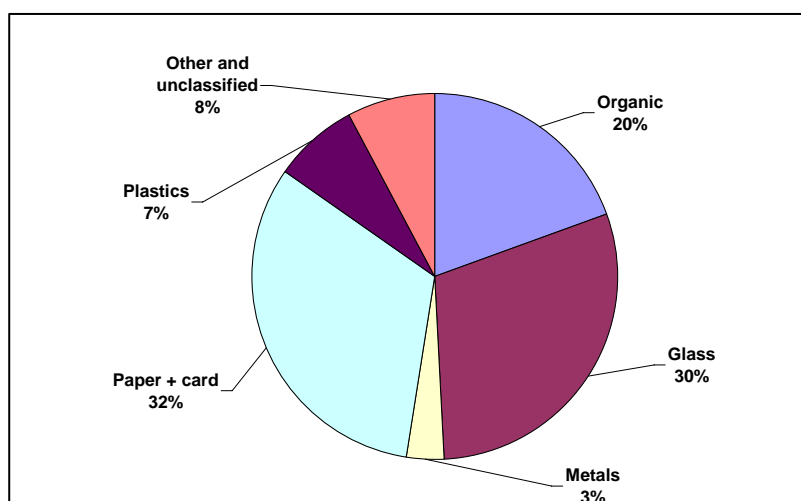
Most of the paper and card waste produced is either board or card packaging material, and is the main resource recycled in any sector. Glass, organics and plastics are the other materials with any significant recycling activity.



**Figure 6.6: Average composition of wastes from food manufacturing SMEs in Hampshire - key resources**



**Figure 6.7: Average composition of wastes from food wholesale and retail SMEs in Hampshire - key resources**



**Figure 6.8: Average composition of wastes from hospitality sector SMEs in Hampshire - key resources**

### **Food manufacturing (SIC code group 15):**

This sector contains a wide range of business activity from breweries, fruit juice manufacture, animal processing, production of ice cream, production of oils and fats, to baking bread and cakes, and consequently is unlikely to produce a homogenous waste stream. This is demonstrated by the high variance in the mean waste produced/employee for this group of businesses in the survey as Figure 6.4 shows. Food manufacturers produce more waste / employee than any other food-related sector, but the sector only accounts for 3% of the total number of food-related SMEs in Hampshire.

Overall recycling activity for manufacturing is the second highest in the food-related sector at 55%, as Table 6.5 shows.

It has the highest proportion of organic waste per business of all the sectors, as might be expected as much of its production waste would be food by-products; and all of the organic waste from this sector is food waste. It is the most effective sector at recycling its food waste with over 90% recycled. This sector also produces a lot of paper and card – mostly packaging material – nearly half of which is recycled. Much of the recycling occurs through routes other than collection by local authorities or waste management contractors, although recycling through these main collection routes is higher for manufacturing than for other sectors at 34% of waste collected for recycling.

recycling activity by sector	% recycled
manufacturing	55%
wholesale	25%
retail (non specialist)	61%
retail (specialist)	28%
hotels	23%
restaurants	10%
bars and pubs	17%

**Table 6.5: Recycling activity of different business groups**

### **Food wholesale and retail (SIC code groups 51.3, 52.1 and 52.2):**

Comprising three SIC code groups – food wholesale, non-specialist retail and specialist food retail – there are similarities and significant differences between businesses in this grouping. Non-specialist retail is predominantly branches of supermarket chains and convenience stores together with some small independent ‘corner shops’, and include more larger outlets. Specialist retail is dominated by smaller businesses with less than 10 employees.

Wholesale businesses produced higher quantities of organic waste resulting mainly from the meat and fruit & vegetable wholesale businesses in this group. However none of this organic fraction was being recycled. Overall recycling activity is fairly low and similar to that for specialist retail. The main material recycled by wholesale businesses was wood from pallets and to a lesser extent paper + card. Specialist retail recycled 50% of their paper and card.

Non-specialist retail, although individual stores in terms of number employed are essentially SMEs, some aspects of their waste management practices will differ from other groups of SMEs through influence of corporate policy and packaging legislation requirements. This group had a high overall recycling rate of 61% and even higher rate for paper and card,

mainly board packaging (81%). Much of the recycling activity was via backfill or returning packaging materials to a central depot for recycling; this was the case for most of the major supermarket chains surveyed including Budgens, Somerfield, Waitrose, Sainsbury, Morrison, Iceland and Londis. Waste disposal and recycling by route other than a main WM contractor or local authority collection is discussed later in Chapter 6.3.2.

Non-specialist retail had the highest percentage of paper + card in their waste at 71%; a high amount of plastic waste (18%) but low proportion of organic at only 7%.

### **Hospitality (SIC code group 55):**

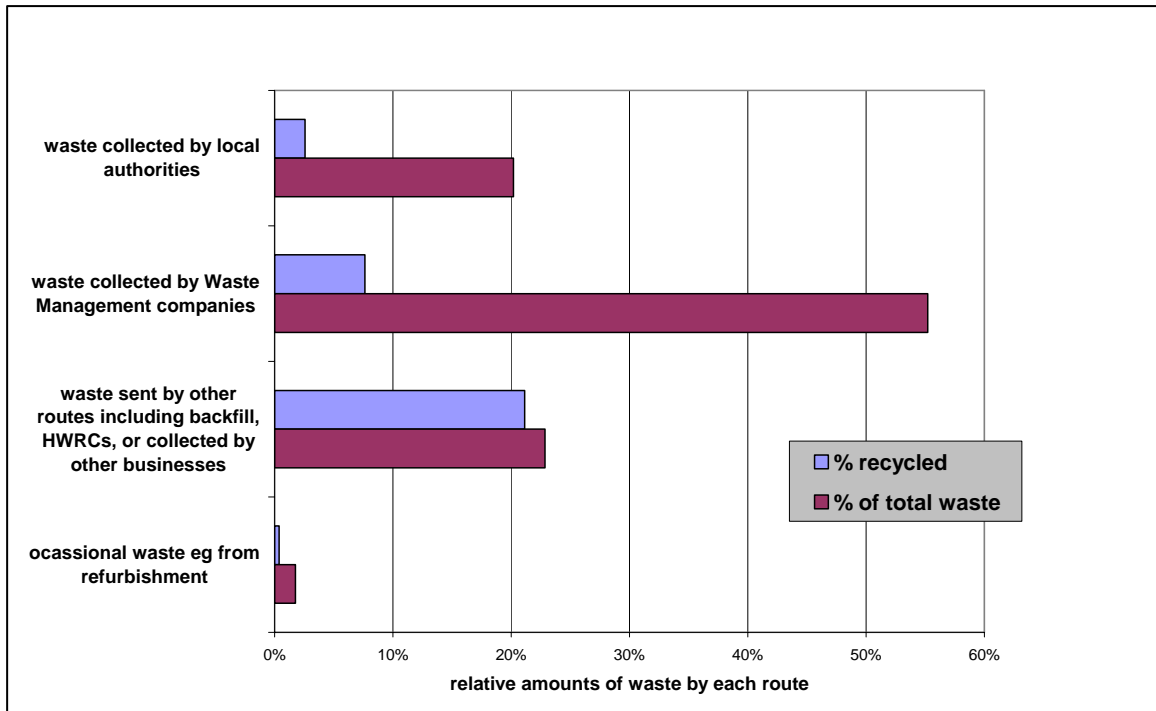
This sector includes hotels; guest houses and camping sites (the latter were excluded from the survey results due to data problems); restaurants, cafes and take-aways; pubs, clubs and bars; and catering and canteens. Again a wide range of business activity is included in this group. Results for SIC code groups 55.2 (guest houses) and 55.5 (catering and canteens) are less reliable than the other groups as the number of businesses in these sample was very small. Consequently although these businesses were included in the overall analysis of the hospitality sector, little weight can be placed on the averages for these groups individually and hence they are often excluded from the results.

This sector produces more glass waste than any other, especially from pubs and bars (44%), and reasonably high proportion of organic waste, particularly from restaurants. Recycling activity is low with restaurants and bars performing worst with overall recycling rates of 10% and 17% respectively. Glass was the material most likely to be recycled by this sector, with hotels recycling 64%, restaurants 19% and bars 26%. About half of the material recycled by hotels and bars was via other routes, whereas nearly all the recycling carried out by restaurants was through their main contractor.

## **6.3. Collection, disposal and recycling routes**

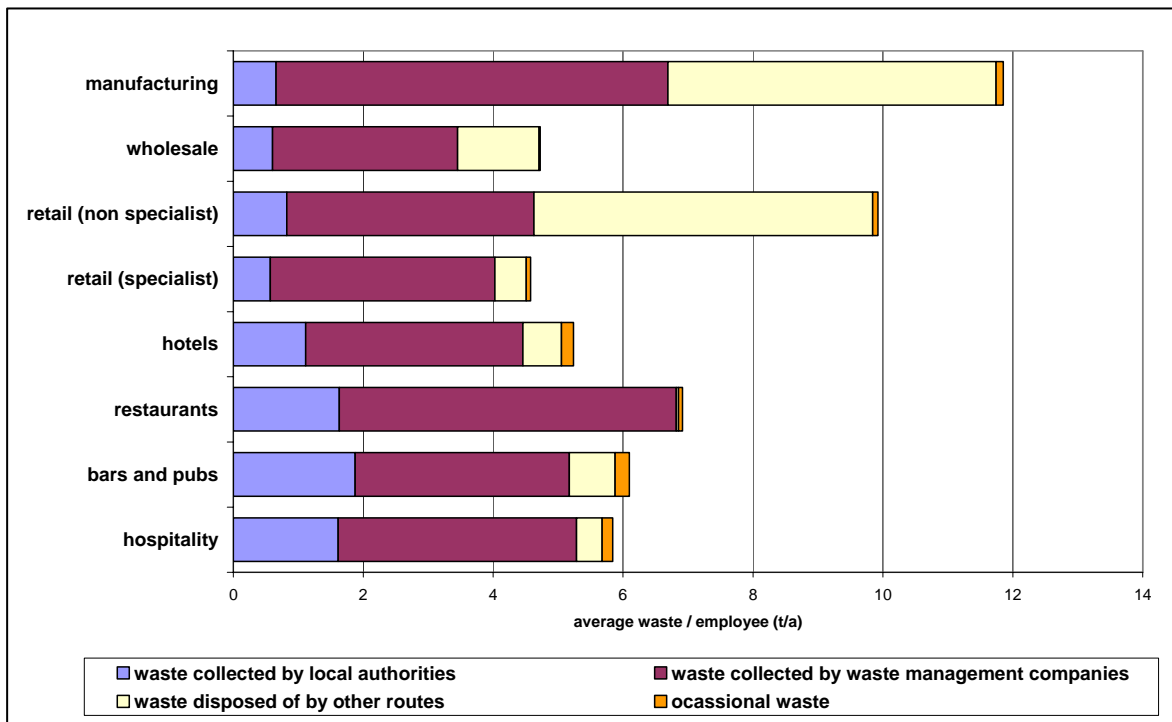
The survey found that 75% of waste from SMEs across the food sector was collected by a local authority or waste management (WM) contractor. WM contractors dealt with 55% of the waste with the other 20% collected by local authorities. More than 20% was recycled or disposed of by other routes. Occasional waste, such as that from refurbishment, was recorded separately in the survey, and only accounted for 2% of total waste. Table 6.9 shows the proportions collected and disposed or recycled by each route. Note that this is presented in proportion to the size of each sector in Hampshire and for all food related business groups.

Manufacturing and non-specialist retail use other routes more than the rest of the sector; for manufacturing businesses this mostly involved arrangements with other businesses to take materials for recycling, and for non-specialist retail as mentioned before through backfill routes.



**Figure 6.9: Waste from SMEs surveyed by disposal/recycled route**

Most of the waste that goes by other routes is recycled (92%), and concentrated in the retail and manufacturing sectors, as shown in Figure 6.10. Local authorities and WM companies recycled only 14% each of the waste they collected. Note that Figure 6.10 is not shown in proportion to the numbers of businesses in or size of each SIC code group or type of business.



**Figure 6.10: Average waste produced by businesses of each type by the route taken for disposal or recycling**

### 6.3.1. Main removal routes by waste management companies or local authority collections

Waste management companies and local authority collections represent the main collection routes for disposal or recycling for waste from SMEs in this sector. Three quarters of waste is dealt with by these routes, with 55% of the estimated waste collected by WM contractors and 20% by local authorities in their trade waste collections. A few businesses used neither route disposing of their waste through the alternative routes described in the next section. Of those businesses surveyed, 76% used WM contractors for mixed waste and/or one type of waste collections, often using different companies for different materials. About 40% used WM contractors for collecting segregated waste for recycling. Just 25% used local authority collections for mixed waste and under 14% for recycling collection, of which about a half were for mixed recyclables and the rest for one type of material.

Micro sized businesses are more likely to use local authority collections, with around 30% of those surveyed using only a local authority collection. However not all local authorities provide a trade waste collection and consequently some businesses could not use this route. More than 95% of small and medium sized businesses used WM contractors as their main waste collection route. A minority of business (around 12%) used both local authority collections and those from a WM contractor, usually for different materials.

In relation to the amounts of waste collected around 1/3 of that from micro sized businesses is collected by local authorities, whereas over 85% of that from small and medium sized businesses are handled by WM contractors.

Recycling activity by either of these routes is low – just 14% overall. However there are some areas where performance is better; 38% of manufacturing waste collected by WM contractors is recycled, and so is 44% of non-specialist retail waste collected by local authorities.

The main materials collected by local authorities from these SMEs for recycling are paper and card – mostly packaging board – and glass. Waste management companies collect a wider range of materials for recycling and some of these contractors operate in specialist markets. By far the majority of that recycled by WM contractors though is again packaging board, followed by plastic film, glass, dense plastics and vegetable oil.

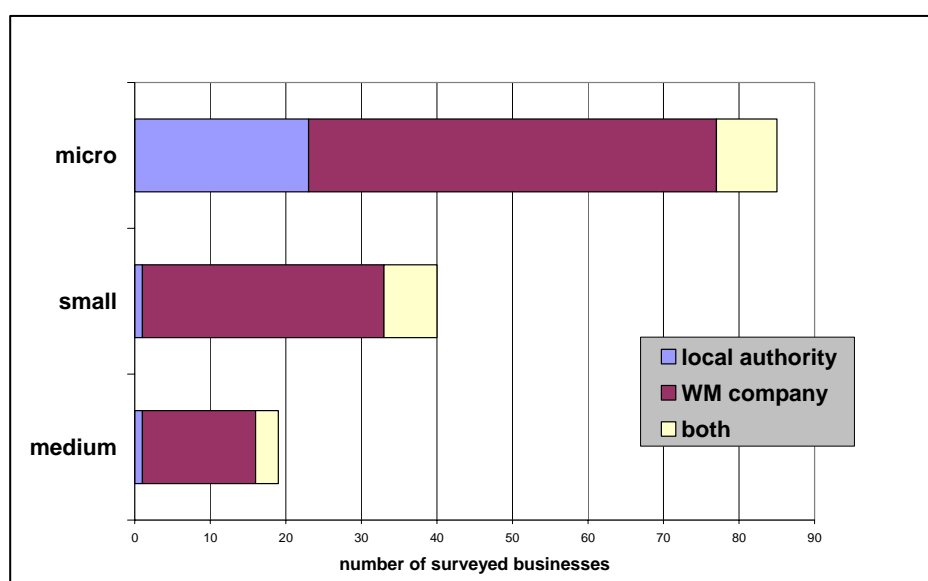


Figure 6.11: Collection routes used by different business size bands

### 6.3.2. Alternative removal options

This section looks in more detail at the other routes for removal of waste used by businesses; that is, all options other than removal by a local authority or private waste, recycling, or reprocessing company. Although a large number of businesses do not use any alternative removal options, just over half of the businesses surveyed did (79 of 151) and just under a quarter (23%) of total waste was dealt with through these removal options. The most common options were taking waste or recyclables to recycling banks or HWRCs, material taken by another business or backfill (i.e. material taken back to distribution depots, mostly packaging material for recycling from retail outlets). Others included recyclables given to charities and even waste taken home.

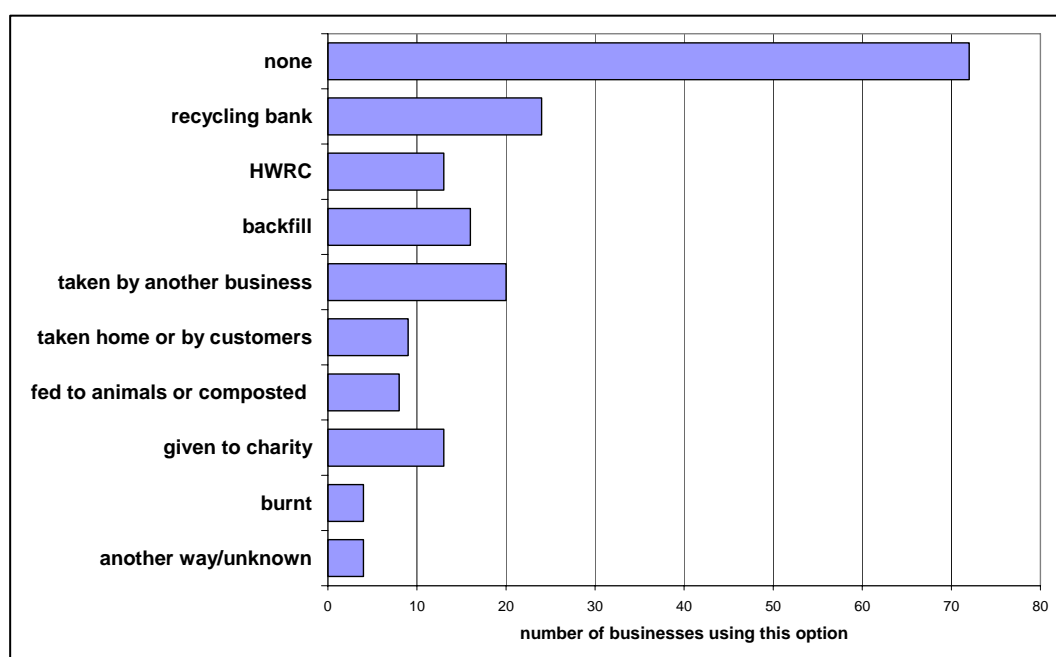
“I take plastic bottles home for recycling – the waste contractor collects this from domestic households for recycling purposes, but will not collect separately from businesses for recycling”

“...could save £70 per month by not having a bin at all and recycling through the domestic HWRC”

“...used to recycle the glass via a public bottle bank until a sign was put up to deter trade users”

Use of recycling banks was the most often cited with 30% of businesses using other options saying they recycled some waste this way, but the amount of material dealt with was small in total – only about 5% of the material recycled by other routes – although it is a fairly significant route for SMEs for glass recycling, and it could have a significant impact at a local level. In comparison 20% of businesses using other options used backfill (all of these were supermarkets or breweries) but accounted for 73% of the material recycled by other routes in the survey sample.

Some businesses use more than one of these removal options to deal with the waste that they generate, although most (63%) only used one. Also some used the same route for different types of waste. As already recorded, most of the waste dealt with through these other options was recycled or re-used, with only 1% disposed of and most of that either taken to HWRCs, burnt or listed as ‘material leaving another way’ (for options not specified).



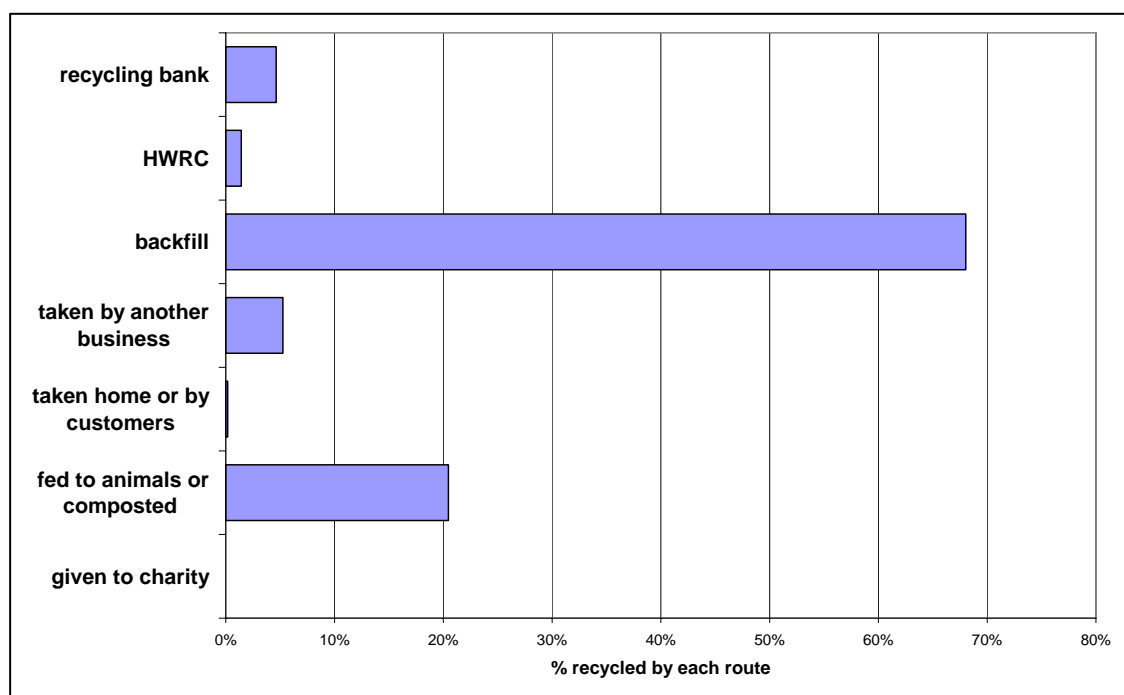
**Figure 6.12: Number of businesses using different other removal options**



Out of the twenty-four businesses that took material to **recycling banks**, twenty-one used these facilities for recycling glass bottles. Most of these businesses only recycled glass, with just two recycling paper and card in addition to glass. Three businesses used the banks solely for recycling paper and card, and the remaining business recycled tin cans. This route was significant for the hospitality sector, where 45% of glass recycling was via this route, and particularly for pubs and bars where this proportion was over 70%.

Those businesses that took material to household waste recycling centres (**HWRCs**) on a regular basis did so primarily for recycling purposes. Of the thirteen businesses that used this method, twelve did so for recycling, whilst four did so to dispose of material. Materials recycled included cardboard, electrical goods, furniture, and fluorescent tubes.

Sixteen businesses used **backfill routes** for removal of material from their business, and most of these were supermarkets/convenience stores. For the majority of these businesses the material sent back was either for recycling or re-use purposes. Only two businesses disposed of any waste by this route; one sent back material for disposal to a central depot, whilst the other sent back a small amount of meat/fish for disposal plus a greater amount of materials for recycling. The main types of material that were sent back to a central depot were cardboard (90%) and plastic film (8%). Additionally, other materials sent back included re-usable items, such as plastic delivery trays (for fruit/vegetables, etc.), and material sent back to the supplier for re-use, e.g. empty beer barrels, refillable glass bottles.



**Figure 6.13: Relative amount recycled by each alternative removal option**

Thirteen businesses donated material to **charities** for reuse or recycling, and the majority of these were hotels, pubs or restaurants. The materials donated included clothing, furniture, mobile phones and printer and toner cartridges. This however only accounted for a very small proportion of the amount of material recycled by other routes – only 0.02%.

Surprisingly more material was taken home, although still only about 0.2% of the waste dealt with by other options. Nine businesses took material home and the majority (78%) of this was recycled; in most cases this was via the person's household kerbside recyclables bin, although in some cases material would be taken on to a recycling bank. Material taken home

for recycling was generally similar in nature to the materials already being recycled by the householder; namely, paper/cardboard, plastic containers, metal cans, and some glass. In one case out of date food, such as food in tins and jars was taken home and eaten. Some waste was also removed from businesses by customers and local growers for further use such as packaging items like cardboard boxes and mushroom trays.

Eight businesses dealt with waste organic materials either to **composting or as animal feed**, accounting for about 20% of the waste dealt with through other options. Arrangements for removal for animal feed were often informal and with a local farmer although not always; and examples included:

- waste by-products from manufacture used by local farmers to feed pigs and cows
- material fed to deer in the New Forest
- fruit and vegetables given to animal sanctuary to feed injured parrots and endangered species
- bread and peelings fed to chickens
- stale bread and cake products used by a local farmer for animal feed

Composting of organic material was either in the premises' garden or with a larger compost heap and included both garden waste and kitchen compostable material, dependant on the nature of the business and type of material they generate. Composting normally takes place on-site, but not always.

A small amount of waste (less than 1%) was burnt by businesses, mostly wood (pallets/crates) and cardboard (boxes). However one business indicated that they burnt other material (polystyrene) but that this was only occasionally.

Twenty businesses used **another business** to take material away from their premises – some of these though may have been waste carriers that did not get picked up under waste management companies in the first section of the questionnaire. This might apply to the three businesses having sanitary waste collected and four who specified other businesses collected oil wastes. The rest of the other business route was more varied and included meat off-cuts, fat and bones taken to be processed and used as a fertiliser; process waste supplied to a local gardener that was used as a green manure; liquid egg waste which is frozen and collected for processing into animal feed; and Hessian sacks used to produce smoke for bee-keeping purposes. Two businesses removed wooden pallets, most likely for re-use or recycling.

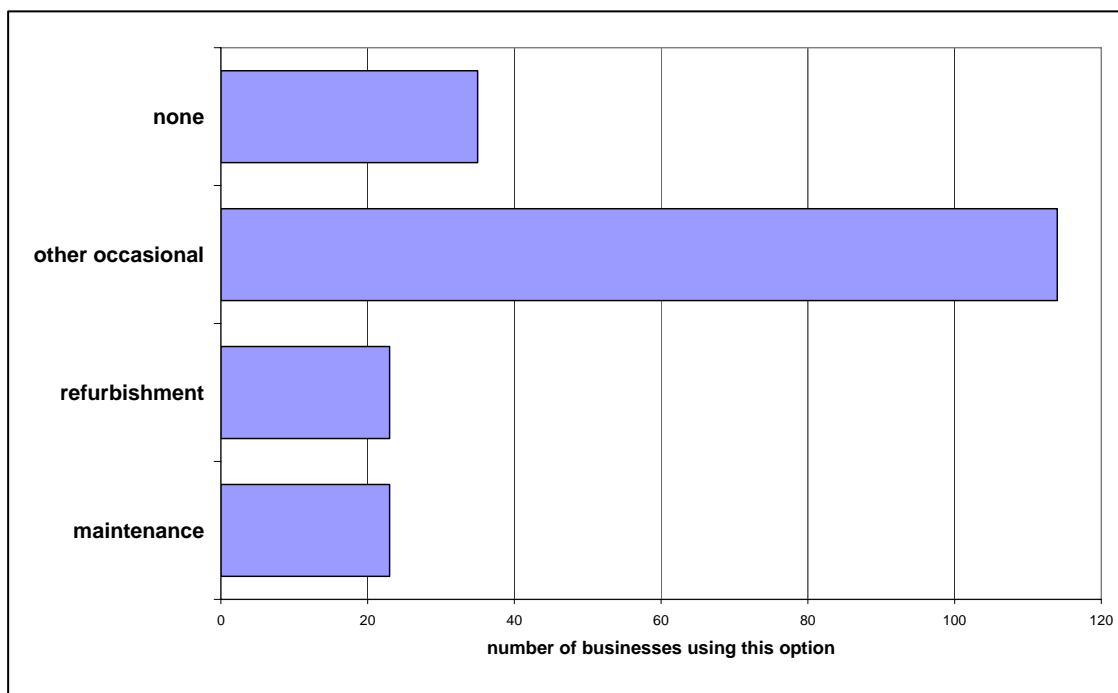
As can be seen, businesses are employing a diverse range of methods to deal with the material that they produce.

#### **6.4. Occasional waste**

This section examines the types and abundance of occasional wastes produced by businesses. Figure 6.14 shows the number of occurrences for each activity across the businesses surveyed. Most businesses (about 78%) produced some sort of occasional waste. The majority of this was from 'other occasional' waste; i.e. waste produced occasionally throughout the year, rather than waste produced less often from maintenance/refurbishment activities. More than 20% produced both maintenance or refurbishment waste and other occasional waste and hence the total number of businesses is greater than the number surveyed.

The amount of occasional waste however is very small – only accounting for about 2% -in comparison to total waste produced. However there are some particular issues that could arise from this waste stream. Specific materials may cause concern where they are classified

as hazardous, such as fluorescent light fittings, or may offer particular recycling difficulties or opportunities where infrequent concentrations of material occur.



**Figure 6.14: Number of businesses producing occasional wastes**

This activity produced the most uncertainty as to whether material was recycled or not, primarily because the waste was often removed by contractors, particularly that generated by refurbishment, or taken to HWRCs, and the businesses were unsure as to what then happened to it.

The most common general occasional waste was lighting – both fluorescent lighting and other types of light bulbs. After lighting the most abundant material is electrical items. These include white goods (fridges, washing machines); small electrical goods (kitchen and audio-visual appliances, including kettles, microwaves, TVs; computer-related items); and various miscellaneous items such as old machinery. The occurrences of the other categories of material are all fairly low, but include for instance, garden waste (generally produced by pubs and hotels), furniture, chemicals and metals; as well as damaged goods such as tin cans and broken glass jars, plus stock clearance items.

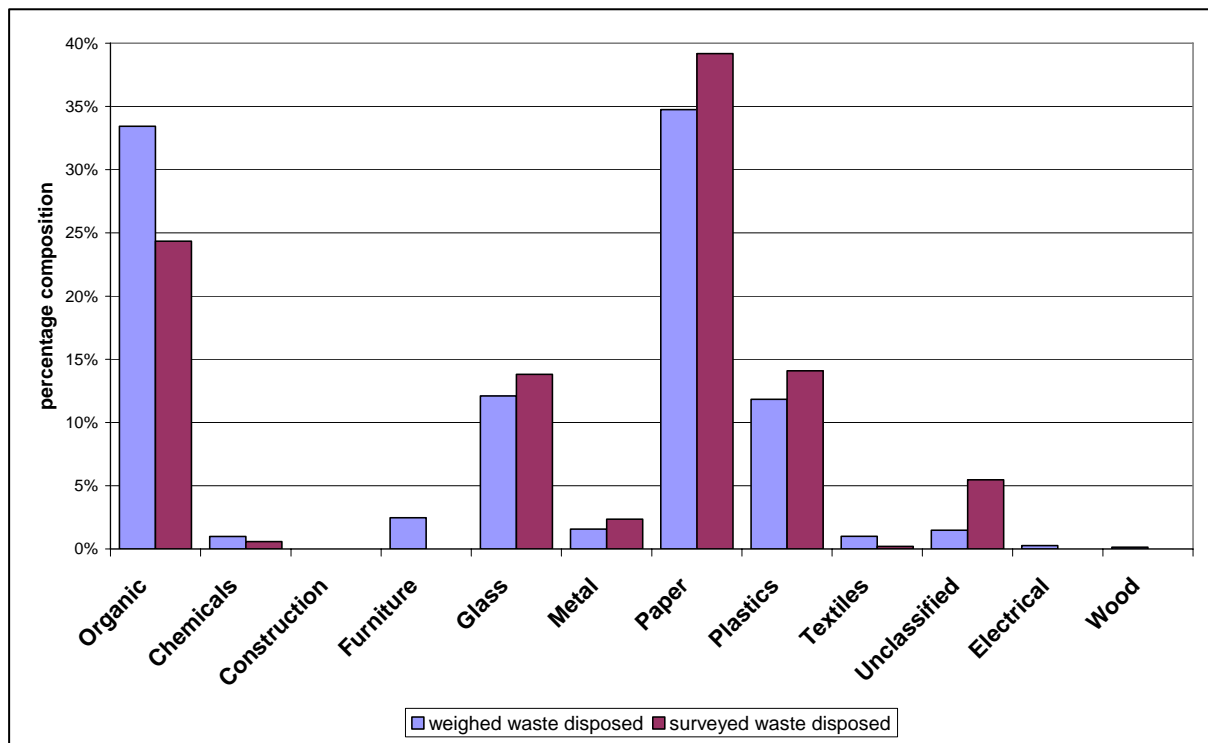
The main types of occasional waste generated from maintenance activities are waste from decorating such as paint tins and old wallpaper, old carpets and furniture. Refurbishment generates similar wastes but in addition includes a greater proportion of building waste (rubble, bricks, concrete, wood, glass).

## **6.5. Waste sampling results**

A number of problems arose during the sampling work and specifically some practical operational issues which resulted in an inadequate volume capacity being provided to many of the businesses. This meant that the total weighed waste data from the sampling was not suitable for comparison with the surveyed waste data as the number of useable results was too small to be statistically relevant. Some individual comparisons were made where

sufficient capacity was provided to hold a full weeks waste and these mostly showed the amount of waste weighed to be less than that recorded in the survey. This may be explained by the timing of the sampling which was during a very slack period for those businesses concerned.

More important though was that from the results of the sampling comparisons were possible between the composition measured and that provided in the survey. Average amounts from the 24 businesses sampled are given in Figure 6.15 and show a good correlation, indicating that the composition estimates given in the survey in these cases were a relatively accurate reflection of the measured waste. Some discrepancy would be expected as the interviewees were asked for average amounts and the sampling could only give a snapshot picture of one weeks waste.



**Figure 6.15: Comparison between composition in survey and for weighed waste**

## **7. Business responses to the survey**

As part of the questionnaire the interviewee was invited to comment on their waste management activities, problems they had encountered, improvements they felt could be made, perceived barriers to recycling, etc. The most common issues commented on by the SMEs taking part in the survey were costs and lack of infrastructure. Although the comments were varied and wide ranging, several themes and ‘buzz-words’ dominated: ‘cost’, ‘incentives’, ‘time’, ‘facilities’, and to some extent ‘frustration/ dissatisfaction’. Indeed, the comments can be synthesised into one overriding phrase ‘we would recycle if we could, but it would have to be cost-effective’.

### **7.1. Cost**

Comments relating to the theme of cost tended to relate to two aspects. Firstly, that businesses would generally only consider recycling (via the local authority or private companies) if it proved to be either cost-neutral or cost-effective. In effect if in order for businesses to recycle it meant that they had to pay more than they were already paying for their waste collection service then they would not consider it. Some examples of the comments made by businesses are given below. It should be noted that the comments quoted in this section have, where necessary, been edited for reasons of anonymity or to correct any original spelling/grammar mistakes.

- “most businesses would be happy to recycle if it was easy and cost effective”
- “businesses will only be encouraged to recycle if it is not going to cost them money or is cost-effective”
- “want to recycle but it isn’t financially viable”
- “little or no cost for recycling facilities before will consider”
- “would like to recycle but it is cost-prohibitive to have different bins to recycle different materials”
- “aware of the potential to recycle the waste but shouldn’t cost any more. Would have to put prices up yet again and profit margin gets shorter and shorter”
- “have been involved in surveys before and been disappointed that surveys before have come to nothing, and would hope that this one achieves something. Cost is the most important factor and that I don t want to pay any more for waste disposal”

Secondly, businesses tended to feel that they should not have to pay to recycle; it was perceived that since recycling was helping to protect the environment then they should not be expected to pay to recycle. Also they considered that recycling must be profitable for the recycling industry and therefore collection should be free:

- “object to paying fee for recyclable material where there is a value and other companies can make profit”
- “why do we have to pay to have our recyclables removed?”
- “more recycling bins for businesses - and should be free”
- “they should pay the businesses to take the waste away as it is all recyclable. Would be good to see it collected with household waste”
- “should not be charges by local authority for recycling containers as there is no incentive to segregate materials”
- “waste is expensive - if they want us to recycle then they should provide the necessary containers to do so but not at our cost”

Some further interesting comments relating to the cost of recycling made by businesses surveyed are:

- “we pay more at present to get the cardboard recycled than it would to just have it collected as mixed waste. It would be better to have green bins alongside the shops, provided by the council, for all of us to recycle”
- “if the council provided a discounted service for collection of recyclables that would encourage me to recycle the plastics and cardboard”
- “waste contractor is not willing to supply Euro bins for recyclable material without additional charges”
- “could save £70 per month by not having a bin at all and recycling through the domestic HWRC”
- “costs of disposal and regulations on small businesses is too high for small businesses. The costs incurred (from the council) mean it is unaffordable”
- “if it can be financially proven that I could save money through recycling and aid the environment I would actively promote recycling”
- “we don’t recycle enough and far too much goes to landfill. However, costs are too much for small businesses”

It can be seen from these comments that businesses feel that they should not be financially penalised for recycling; and many were somewhat confused as to why they should have to pay more (or anything) to recycle their waste rather than dispose of it.

## **7.2. Incentives**

Related to issues of cost is the theme of incentives. As can be seen from the selection of comments below, many businesses felt that there need to be incentives coming from government and local authorities to encourage them to recycle. In addition they often commented that waste contractors could/should provide greater incentives for them to recycle.

- “need incentives for recycling; government needs more to encourage industry to build the infrastructure for recycling - i.e. plant where dirty plastics can be sent for washing, then recycling”
- “if businesses are given incentives to recycle waste the majority would be willing to comply”
- “would like council to encourage as no incentives at present - recycling costs are too high”
- “there need to be more incentives for waste management companies to offer recycling options”
- “have contacted waste contractor regarding potential to compost organic waste, but no financial incentive to do so”
- “at the moment the waste company I use said they could provide a bin for cardboard but it would go in the same truck as the refuse”

## **7.3. Time**

Another barrier to recycling for businesses is the ‘cost’ in terms of time, as small businesses have a limited number of staff and often cannot afford the time to separate material for recycling:

- “cost of recycling - i.e staff aspects”
- “recycling is difficult to implement due to restrictions with space and time (i.e. would need to divert staff time from serving towards segregation)”
- “recycling is difficult to implement as difficult to segregate materials during busy periods, and also limited space for segregation”

- “time and costs involved mean we are very limited. Having a day off could be under threat as half of that time could be taken up by having to sort rubbish. Cost effectiveness. Cannot afford to invest in either a piece of ground for storage or a van to transport it around”
- “logistics of keeping the recycle; time cost and management of it all that is the barrier”

## 7.4. Facilities

There are several aspects that relate to this section, which broadly can be grouped into those relating to either lack of space for businesses to be able to recycle and the lack of facilities available to businesses.

Lack of space for appropriate facilities or for storing materials was an issue for many of the small businesses surveyed:

- “wouldn’t want to have more large bins”
- “no space for storing waste”
- “lack of facilities - car park space that is council owned is available nearby that could be used for recycling facilities, both for general public and businesses, particularly for cardboard”
- “would like to recycle but no system in place to do so particularly because of rural location”
- “if there was provisions to recycle on site then business would do this - would be better if had different containers for different recyclables. and would have to be cost-effective”
- “if the recycling facilities were provided this company would happily segregate materials”
- “in favour of recycling, but no facilities are easily available to achieve this”
- “concerned that there are no facilities for small business recycling”
- “don’t want to take any waste home in my handbag - if there was a recycling facility downstairs that would help”

For many of the businesses surveyed there appeared to be the desire to recycle if the facilities existed, and the implication that facilities should be provided in order to enable them to recycle. Some businesses had attempted to recycle but had not been able to because of lack of facilities. This was because either their waste contractor does not offer a recycling service; or a business has contacted a company with regard to recycling but has been unsuccessful, sometimes because the recycling company does not have the capacity to take on extra businesses.

- “willing to recycle but the facility is not available. Waste contractor take mixed waste only from one container”
- “as far as I know none of my waste is recycled by the company I use. The local authority said that they cannot provide recycling services for businesses”
- “tried to recycle glass but the company was not interested”
- “waiting for place on purple bin programme (anything recyclable would go in there), but not enough capacity on scheme to cater for all businesses”
- “produce a lot of material that could be composted - if the facilities existed”
- “takes plastic bottles home for recycling – waste contractor collect this from domestic households for recycling purposes, but will not collect separately from business for recycling”

The issue of local authority provision figured prominently in comments from small businesses, who generally felt that local authorities should be encouraging small businesses to recycle, and should be providing facilities for them; and, to a certain extent, should not be providing barriers that hinder them in their recycling efforts.

As small businesses, many of those surveyed are not subject to the Packaging Waste Producer Responsibility Obligation legislation that requires larger businesses to recycle some

of their packaging waste, and they receive little information from their local authority or waste contractor encouraging them to recycle. Hence, their attitudes are based around the information they receive as their other role as a householder. As householders they are encouraged to recycle as much as possible by their local authority, which provides free facilities in order for them to carry this out. Also the messages they receive from the Government, local authority, media, etc is that recycling is essential to protect the environment. Therefore the small businesses cannot understand why they are also not encouraged to recycle or that they should be expected to pay for it. They often perceived it as a conflict between how they are treated and expected to behave as a householder and the treatment they received as a business.

Many of the comments from businesses concerned this issue of local authorities' responsibility to provide recycling services:

- "local authority does not collect recyclables from businesses - would be good if they did so that we did not have to take it home or put it in our refuse bin"
- "not enough being done by local authorities to cover waste that can be recycled - i.e. not collecting all that can potentially be recycled. local authority should provide a sensible recycling system so that households and businesses alike can use it"
- "the council should encourage businesses to recycle - introduce bin system (particularly for kitchens)"
- "would like council to provide recycling bin"
- "wish council would supply designated glass recycling bins. Have contacted council but nothing applicable to area (recycling bins)"

Another theme that was raised by some businesses related to the fact that recycling was difficult due to the fact that they either shared bins with other businesses or the owner of the premises provided containers for them. This raises the interesting point that if cooperation between businesses could be achieved or the owners of business centres could be persuaded then the use of communal recycling facilities could possibly lead to cost-savings for those businesses due to the increased amounts of recyclables available from a group of rather than individual businesses.

- "if the facilities were available, e.g. appropriate bins for recyclables, then we would do it, but not made available by the owners of premises"
- "need separate collections for individual waste types. Makes it difficult sharing waste container with other companies so can't easily adopt recycling"
- "would recycle if facilities were available but due to sharing bins with numerous other companies, option not available"
- "waste management handled by enterprise centre - surprised that they do not have any separate collection or facilities for recycling material"
- "why can't companies get together and pool waste to make it easier?"

## **7.5. Dissatisfaction/frustration**

The comments relating to dissatisfaction/frustration felt by businesses has been split into those relating to local authorities, and those relating to private waste companies. The former comments follow the same underlying theme as mentioned above: businesses feel that local authorities should be encouraging small businesses to recycle, and should be providing facilities for them; and, to a certain extent, should not be providing barriers that hinder them in their recycling efforts. This relates in particular to the fact that businesses do not perceive it to be wrong to use the domestic recycling infrastructure to recycle material from their business. Generally businesses do this because they have a desire to recycle but the cost is



prohibitive. For example one business was no longer recycling bottles because of the cost, whereas they had previously recycled the glass via a public bottle bank until a sign was put up in order to deter trade users.

Additionally, businesses also feel that there is too much emphasis on recycling by householders, and not enough on recycling by businesses. Once more, businesses seem to be linking the role that local authorities play with regard to household recycling, the fact that they are told (as householders) that recycling is important, and the perceived view that they are left to their own devices when it comes to recycling as a business.

- “the council could do more - we rang them up, but they were not interested in provided recycling bins”
- “the council is too focused on household recycling, not enough emphasis on business recycling”
- “outrageous that we don’t have council recycling when we have to pay extortionate rates. We do like to see our waste being recycled”
- “if local authority is keen to recycle, why do they charge for items such as fridges etc in their bulky waste collections. The council needs to encourage business recycling more”
- “I have been separating my rubbish for at least tens years, but the council need to get their act together”
- “councils will not collect green recyclables bin if has lots of cans in it - classed as trade waste, but have to pay extra to have recyclables collected separately as trade waste - even though paying two lots of rates (business and domestic)”
- “no recycling facilities for trade waste – all in the bin together. Also, why can’t we get rid of WEEE at the HWRCs? The public get this for free but we have to pay £80 per item when we have already paid for trade waste collection”
- “the service offered by local authority is not value for money, and there is no choice on frequency of collections - no flexibility and supply of collections does not match demand produced”

With regard to private waste companies, dissatisfaction is expressed both with the range of services offered and the fact that the waste contractors do not appear to be encouraging businesses to recycle. Indeed as can be seen from the comments below (and elsewhere) several businesses cited instances where although waste contractors would collect separate recyclables, they felt that the material was not being recycled since it was going into the same truck as the residual waste.

- “would like to be able to separate waste but no point if do it and then the waste company puts it all into the same truck”
- “our waste collectors charge us for two bins, one for cardboard and the other for everything else. The cardboard one is more expensive but when the binmen turn up all our waste goes into the back of the same lorry”
- “waste management services available to businesses is somewhat unregulated in terms of what they offer - say one thing but do something else i.e. say will recycle but then put everything in one truck”

## **7.6. Information and awareness**

Here the comments made by businesses relate primarily to the lack of information available to them; and the uncertainty of where to go to obtain this information. This is with regard to both receiving advice on how and what to recycle; an information about companies that can recycle the different materials that the businesses produce. In particular some commented on their lack of knowledge about what to do with special materials where they do not produce enough material to have separate collections.

- “dismantling components for waste is difficult - we don’t know who to send the waste components to. Catering waste is a problem, but don’t know who to send it to”
- “would be good to have colour-coded bins to enable easier recycling; would be good to have a system whereby easier to identify what can and cannot be recycled”
- “can only recycle one type of plastic – why not tubs?”
- “waste companies running businesses focussed on profit does not advise SMEs on waste matters”
- “must be some system for recovery of fluorescent as cannot use HWRC and cannot dispose in mixed waste. Also applies to batteries.”
- “what can we do with our plastic film waste? We produce so much of it and no one seems to know what to do with the waste. If it’s so bad then why do we have to use it in the first place?”
- “tried recycling plastic but it is not achievable as balers are not user-friendly”

The need for somewhere to go for help and advice – particularly trusted independent advice – was something commonly commented on by businesses. This highlighted the general lack of knowledge of information and support services that do exist, as well as in some cases ignorance of the legal requirements for businesses to deal appropriately with their waste.

- “no need for a composter, we throw our grass cuttings over the fence. It’s okay there as it belongs to the MOD”
- “I sweep up all the mess from the front of my shop and put it into the litter bin. The Council have now told me to stop, which I can’t understand as I’m doing their job for them”
- “I can’t afford to pay for a trade waste collection as we run on such a tight margin. My father takes all my glass and puts it in the recycling bank”
- “thank you for coming and taking an interest. We feel as if we are just left to try and sort this out for ourselves. Our waste company only seems interested in taking our money even though we’d love to recycle”

## 7.7. Miscellaneous

Various other comments were made by businesses that do not readily fit into the themes above. Many of these indicate an endorsement of recycling as well as the variation in the level of awareness and recycling activity of businesses. Whilst some are already actively recycling, others recognise the need to recycle, and are seeking to do so. However, it is clear that many businesses were finding it difficult, and was often only considered for purely financial reasons. One came up with an inventive solution:

- “I realised that I was preparing portions which were too big as we had a lot of leftovers waste so I have changed the menu to nouvelle cuisine. Now we don’t have any leftovers waste”

Some businesses also recognised a need to raise levels of awareness regarding recycling.

- “happy as aware of what is involved”
- “aware that could be doing something - looking in to the possibility of getting a cardboard bin, and possibly a glass bank”
- “need more time to recycle more but we are trying. Using different techniques to reduce the amount of packaging and waste we produce - not for environmental reasons, purely cost. However, it’s great to see the results”
- “lot of room for improvement to make people aware of recycling”
- “something needs to be done to protect the environment. Education at school level”
- “need regular audits from waste authorities to establish companies recycling rates and encourage recycling”

Another issue raised by some businesses was the desire to reduce the amount of packaging. This was both from the customer's side (e.g. carrier bags) where there was concern about the cost to the business and the levels of waste this generated, and on the supplier side where businesses were frustrated by the amount of packaging used which would invariably lead to greater amounts of material that had to be dealt with by the business.

- "mandatory charge for plastic bags would be good"
- "plastic bags should be taxed - it costs us £60 per week for plastic bags because the customers want them. Need to change their attitude towards this and bring a shopping bag like we used to when we were young"
- "wish that growers would not use so much foam polystyrene stuff in their packaging for fruit and vegetable goods coming in"
- "annoyed by the amount of packaging used by supermarkets and takeaway"

There was also general frustration with what the Government are perceived to be doing or not doing. It seems that the messages regarding waste management in general (including landfill targets, new infrastructure planning, etc) are not filtering through to this sector:

- "Government is going cart before the horse, get the infrastructure right before bringing out new initiatives"

## **8. Resources in the waste stream of food sector SMEs in Hampshire**

### **8.1. Analysis approach to grossing-up for the Hampshire audit**

The averages waste/employee data provides comparisons and averages for each business SIC code group surveyed, for the composition of the wastes from each group, and what routes are used for collection, disposal and recycling. However in extrapolating from this data to estimate the potential resources in the waste stream from food-related SMEs for Hampshire, account needs to be taken of the number of businesses in each sector and in each size band.

Data was acquired from the Office of National Statistics (ONS) for the numbers of businesses (unit counts of individual locations of businesses) for the specific SIC codes and size bands that were covered by the survey. Analysed data from the survey results record mean values and composition for waste/employee for each business type, and therefore before the results can be grossed-up to the whole population of SMEs, estimates are needed for the average waste /business for each size band. The approach taken was to use mean waste/employee data together with national average data from the Department of Trade and Industry (DTI) on business sizes to produce these values for average waste/business in each size band. The mean waste/employee data is more statistically robust than that obtained in the survey for waste/business as samples in some size bands were too small to produce reliable results.

Data is available from the Small Business Service Analytical Unit, DTI on the number of employees and number of enterprises for micro, small and medium sized businesses nationally which can be used to provide an average number of employees for each size band as shown in Table 8.1.

SIC code group	Business size		
	Micro	Small	Medium
15	5	23	109
51.3	4	20	97
52.1	4	18	102
52.2	4	19	80
55.1	5	23	96
55.2	4	21	n/a
55.3	4	19	96
55.4	4	18	91
55.5	4	19	n/a
55 average	4	19	95

Source: Small Business Service Analytical Unit, DTI

**Table 8.1: National average number of employees for food related SMEs**

This gave the estimated values for waste/business for micro, small and medium sized SMEs in each SIC code group shown in Table 8.2.

Business type	average waste total / business (t/a)		
	Micro (2-9 employees)	Small (10-49 employees)	Medium (50-249 employees)
Manufacturing	56	275	1,301
Wholesale	20	96	459
Non-specialist retail	38	179	1000
Specialist retail	18	85	366
Hotels	24	119	504
Guest Houses	9	48	221
Restaurants	27	129	663
Bars	27	109	554
Catering	11	54	275

**Table 8.2: Estimated average values for total waste/business in food sector SMEs**

The values were checked by comparing the mean values obtained for those cells with adequate samples, and also by comparing the results with the EA 1999 surveys data. Table 8.3 below shows the results for micro businesses. There are some discrepancies between the values but these were within the expected range of values predicted. Values from the Hampshire survey are consistently slightly higher than those from the EA 1999 survey, but as explained earlier this might be expected as the methodology of the wasteQUEST questionnaire focuses on capturing information on all potential resources in the waste stream and materials currently recycled.

Business type	Average waste/micro sized business (t/a)		
	Calculated from waste/employee and average business size	Taken from surveyed values	EA 1999 survey values
Manufacturing	56	38	56
Wholesale	20	11	13
Non-specialist retail	38	40	21
Specialist retail	18	16	17
Hotels	24	22	16
Restaurants	27	26	17
Bars	27	27	15

**Table 8.3: Comparison of values of waste/business for food sector SMEs**

## 8.2. Waste audit results for Hampshire food sector SMEs

The total waste produced by food-related SMEs in Hampshire has been estimated from the waste/business for each business type and size band calculated from the survey data on average waste arisings per employee and national average number of employees in each business size band, and the number of businesses of each type and size in Hampshire. Table 8.4 shows the results.

business type	Estimated total waste for Hampshire (t/a)			
	Micro (2-9 employees)	Small (10-49 employees)	Medium (50-249 employees)	total
Manufacturing	3,930	11,006	19,519	<b>34,455</b>
Wholesale	2,375	6,217	9,175	<b>17,767</b>
Non-specialist retail	15,115	78,827	89,969	<b>183,911</b>
Specialist retail	7,897	3,837	1,830	<b>13,565</b>
Hotels	1,591	10,130	22,684	<b>34,405</b>
Guest Houses	429	478	1,105	<b>2,012</b>
Restaurants	21,882	35,985	29,846	<b>87,713</b>
Bars	20,808	50,580	2,771	<b>74,158</b>
Catering	3,284	8,612	5,494	<b>17,390</b>
<b>total</b>	<b>77312</b>	<b>205671</b>	<b>182393</b>	<b>465,376</b>

**Table 8.4: Estimated total waste from food sector SMEs in Hampshire**

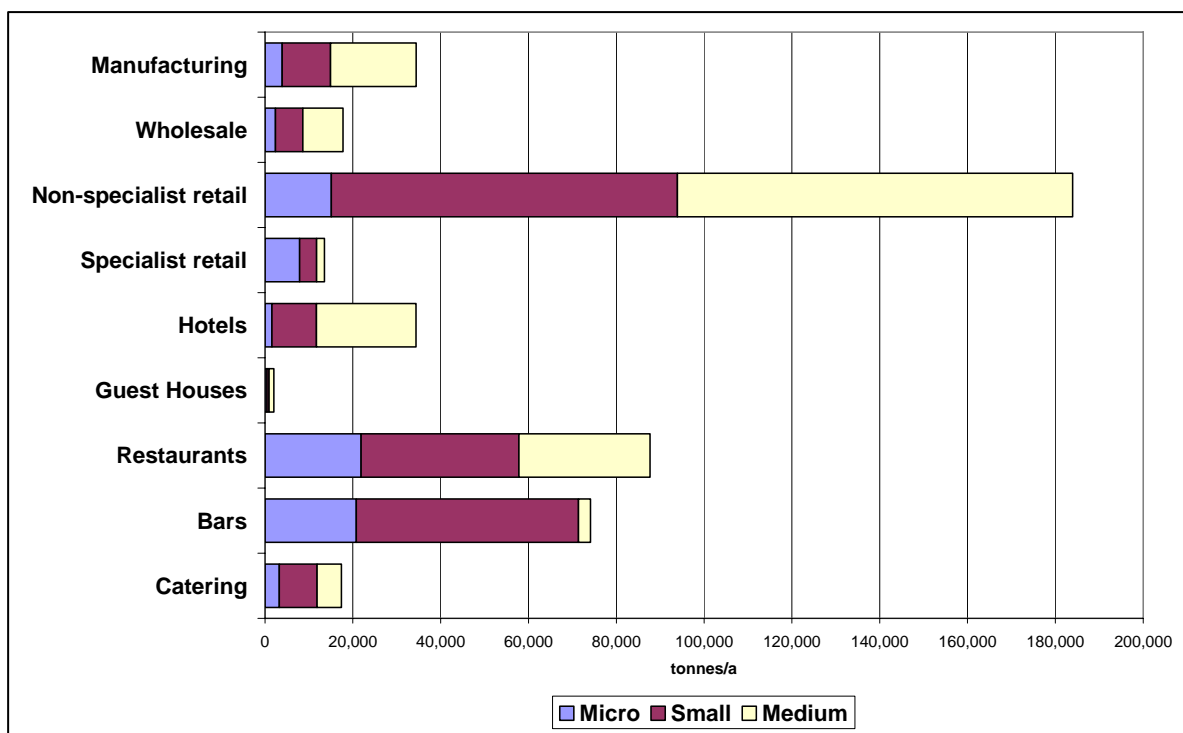
The calculated total waste arisings for food manufacturing, food wholesale and retail and the hospitality sectors for Hampshire are estimated at just over 465,000 tonnes per year. This compares with just over 836,000 tonnes of household waste collected in Hampshire in 2005/06 (HCC, 2007).

This estimate should be considered in context of the 90% confidence interval range for the mean values obtained in the survey data for each of the SIC code groups, since the results obtained had a high degree of variability. Using this data, it is estimated that the range of values for total waste from food sector SMEs in Hampshire is between 330,000 and 600,000 tonnes pa, which is the mean value of 465,000 tonnes +/- 30%. In grossing-up the results further errors may have been introduced, however these are not calculable from the available data.

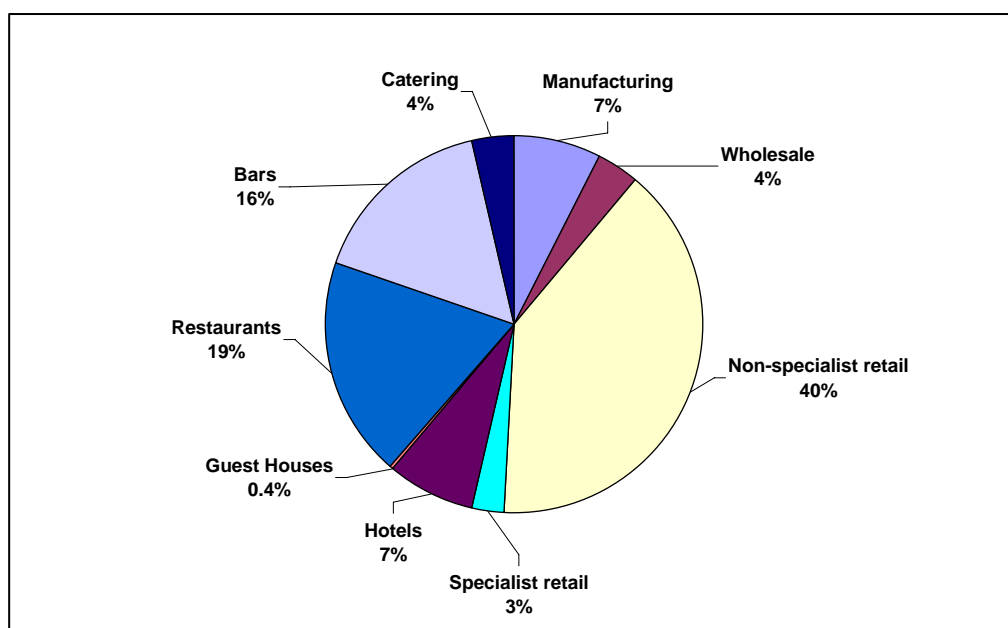
The overall contribution from micro and small businesses with fewer than 50 employees which account for 95% of food-related businesses in Hampshire was 61% of the total waste. The micro sized businesses were the most numerous at 62% of the total but produced only 17% of the total waste. Medium sized companies which only account for 5% of the total number of businesses produced 39% of the total waste arisings. The proportions for each business type are shown in Figure 8.2.

Figures 8.1 and 8.2 show the relative total amounts produced by each business SIC code group in relation to the size of each sector in Hampshire. Non-specialist retail (supermarkets and convenience stores) produce the greatest quantity of waste, with most arising from small and medium sized businesses.

Restaurants and bars also produce significant quantities of waste with most produced in these cases by the micro and small businesses which account for 98% of the businesses in these sectors.



**Figure 8.1: Estimated waste produced by food-related SMEs in Hampshire by business type**

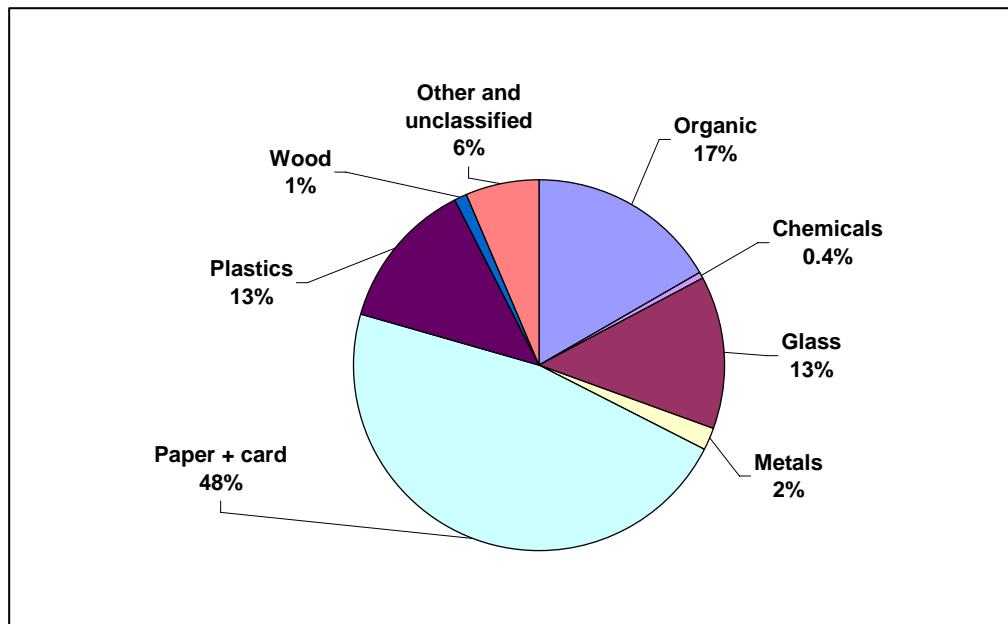


**Figure 8.2: Estimated total waste from food-related SMEs in Hampshire by sectors**

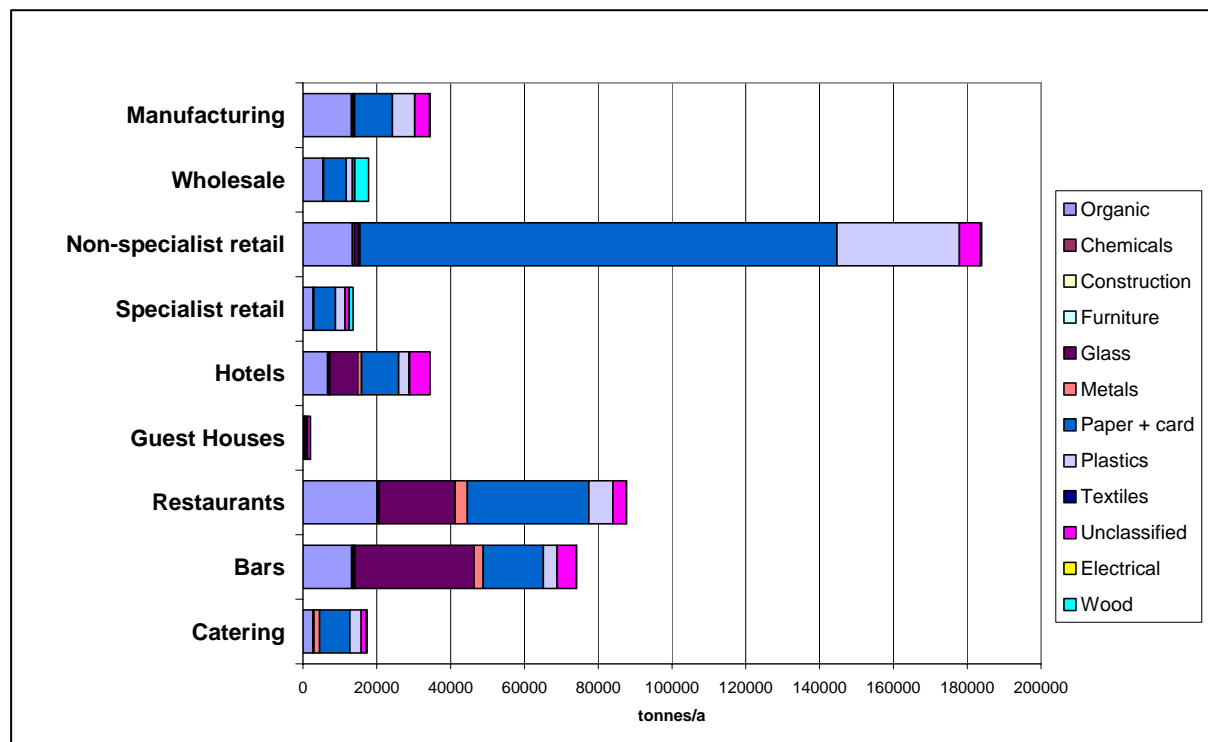
### 8.2.1. Composition of wastes from food sector SMEs in Hampshire

The key resource components of this SME waste stream estimated for Hampshire as a whole from the survey data is shown in Figure 8.3. Paper and card are the most significant at nearly half the waste stream (48%); organic waste is the next largest at 17%, followed by glass and plastics at 13%. Figure 8.4 shows the composition and size for each SIC code group in Hampshire as estimated tonnes per year produced.

The organic fraction of waste is predominantly food waste – overall 94%, with just 6% comprising other organics such as parks and garden waste and soils. The food waste fraction is mainly biodegradable kitchen/catering food waste (85%) split fairly evenly between that not containing meat as that which does contain meat; and the remaining 15% is animal or vegetable oil.



**Figure 8.3: Average composition of wastes from food sector SMEs in Hampshire - key resources**

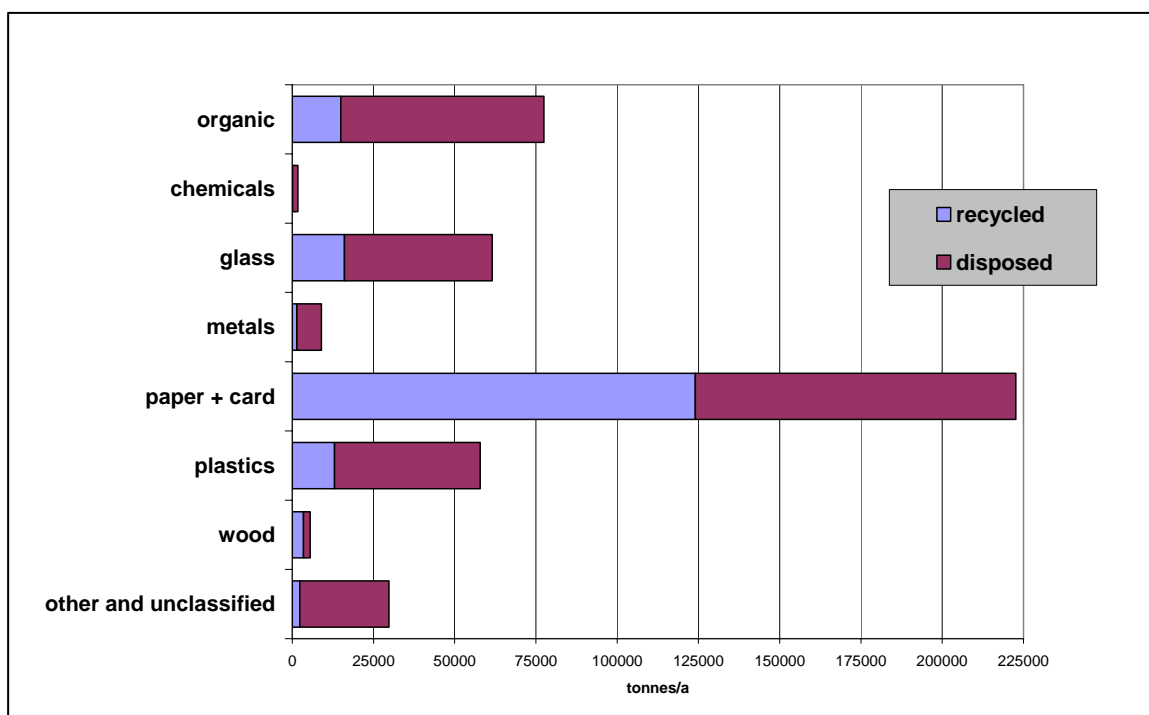


**Figure 8.4: Estimated amount of waste from food sector SMEs in Hampshire by composition and business type**



### 8.2.2. Current recycling activity

The overall recycling rate for this sector in Hampshire is estimated from the survey at around 38%. Of this just over 70% is paper and cardboard, with the rest split fairly equally between glass, organics and plastic, plus a small amount of wood. The proportions for each material are shown in Figure 8.5.



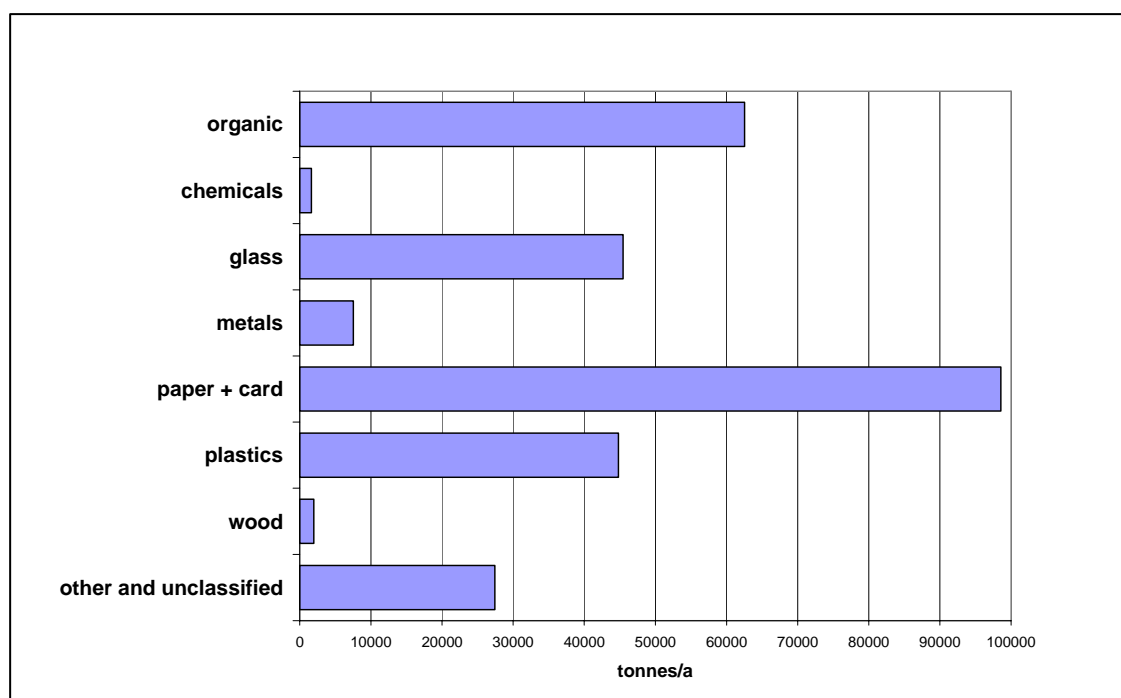
**Figure 8.5: Estimated amount recycled/disposed from food sector SMEs in Hampshire**

Most of the paper and card waste produced is either board or card packaging material, and has the highest recycling rate amongst the main resources in the waste stream at 56%. Wood however produced the highest estimated recycling rate – primarily because most of the wood found in the waste stream was from pallets which were collected by specialist businesses for recycling; however this was a very small fraction of the overall waste stream at 1%.

Across the sector as a whole 81% of the organic waste produced is disposed of; and of the 19% recycled the majority (72%) is food waste not containing meat; 5% food waste containing meat; and most of the rest is vegetable oil (20%). Of the organic waste not currently recycled 93% is food waste but around half of this is food waste containing meat or animal oils/fats.

Almost all of the estimated 16,000 tonnes of glass recycled per annum from food sector SMEs in Hampshire comes from hospitality businesses, with most of this from bars, restaurants and hotels. Taking this to recycling banks, often cited in pub or hotel car parks is an important route for this material with nearly half (7,500 tonnes) dealt with this way. It is even more significant for pubs and bars where more than 6,000 tonnes or 72% is recycled at recycling banks.

The waste currently disposed of from food sector SMEs in Hampshire is estimated at just under 100,000 tonnes of paper and card, over 60,000 tonnes of organic waste, about 45,000 tonnes each of plastics and glass. This offers significant amounts of resources that may be potentially recyclable with suitable collection provision. However it was not possible to identify from the survey results the degree of contamination of these wastes and hence where additional recycling opportunities may be found. Figure 8.6 shows the estimated amounts of the key resources currently disposed of by this sector in Hampshire.



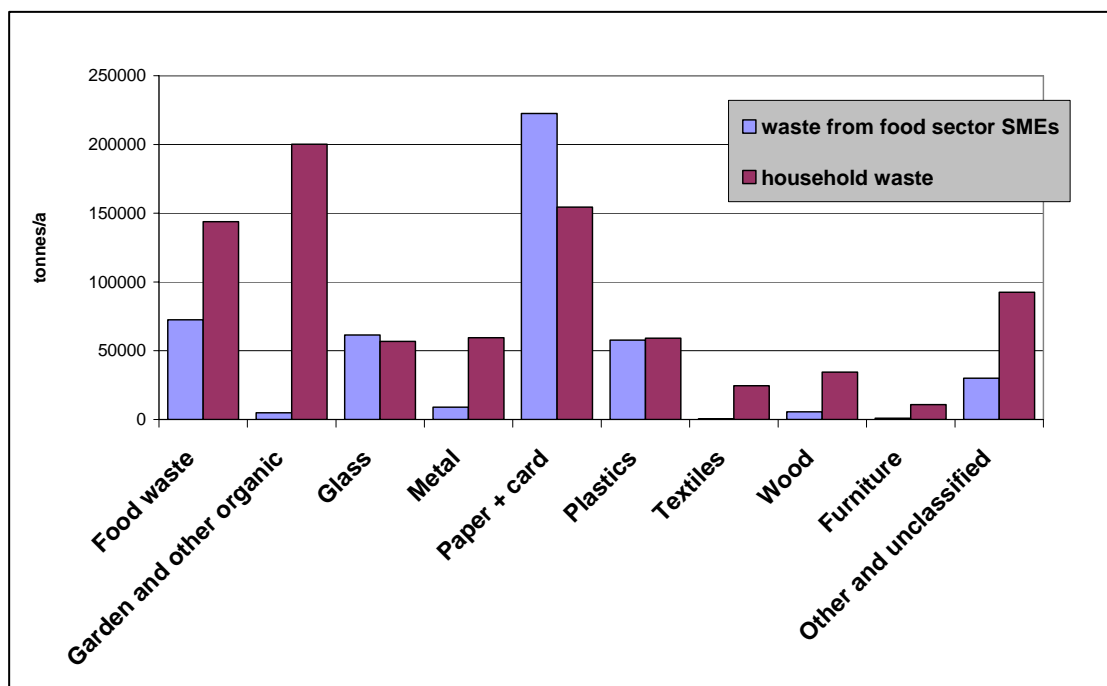
**Figure 8.6: Estimated waste currently disposed from food sector SMEs in Hampshire**

### 8.2.3. Comparison with resources in household wastes from Hampshire

Many of the resources in food sector SMEs are similar to materials found in either municipal solid waste (MSW) or household wastes collected by local authorities. Opportunities for the co-collection or co-processing of household and business waste are increasingly being considered to improve overall recycling performance. This section compares the amounts and composition of these waste streams as a precursor to such analysis.

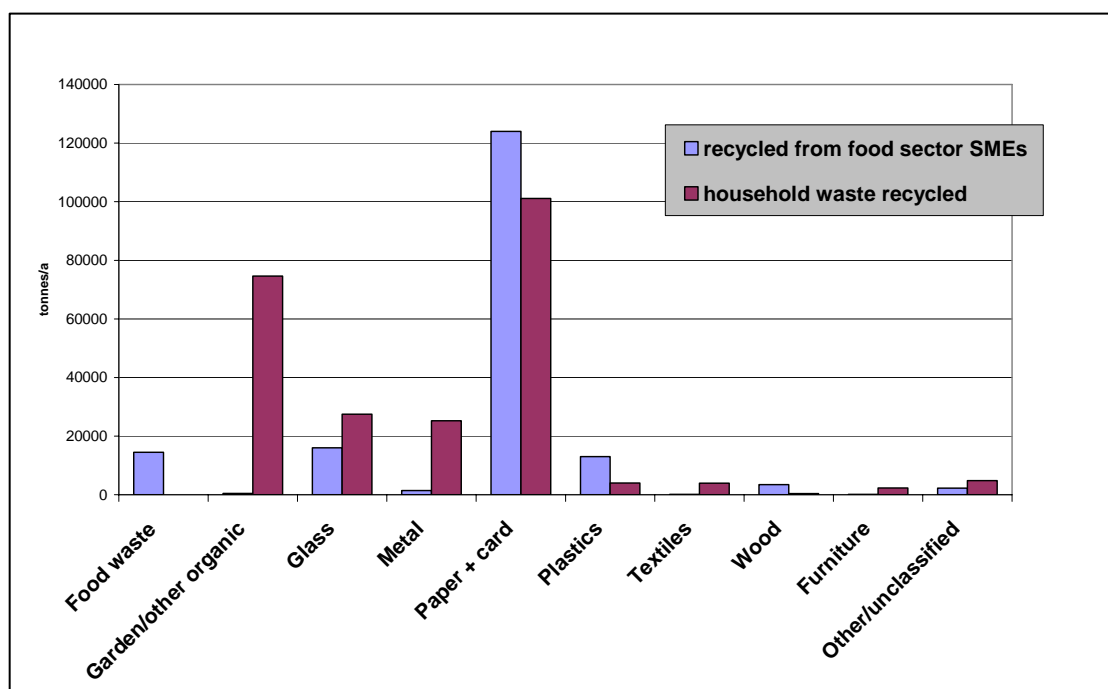
In 2005/06, 836,000 tonnes of municipal solid waste were collected from households in Hampshire (HCC, 2007). No recent compositional data is available for Hampshire household waste, so national average composition data from the 2002 Strategy Unit analysis (Parfitt, 2002) was used to estimate the amounts of each resource type in the household waste stream. Figure 8.7 shows a comparison of the total estimated waste from households and food-related sector SMEs in Hampshire.

Paper and card, glass, plastics and organic food waste are all materials where there are significant amounts of both household and SME food sector wastes.



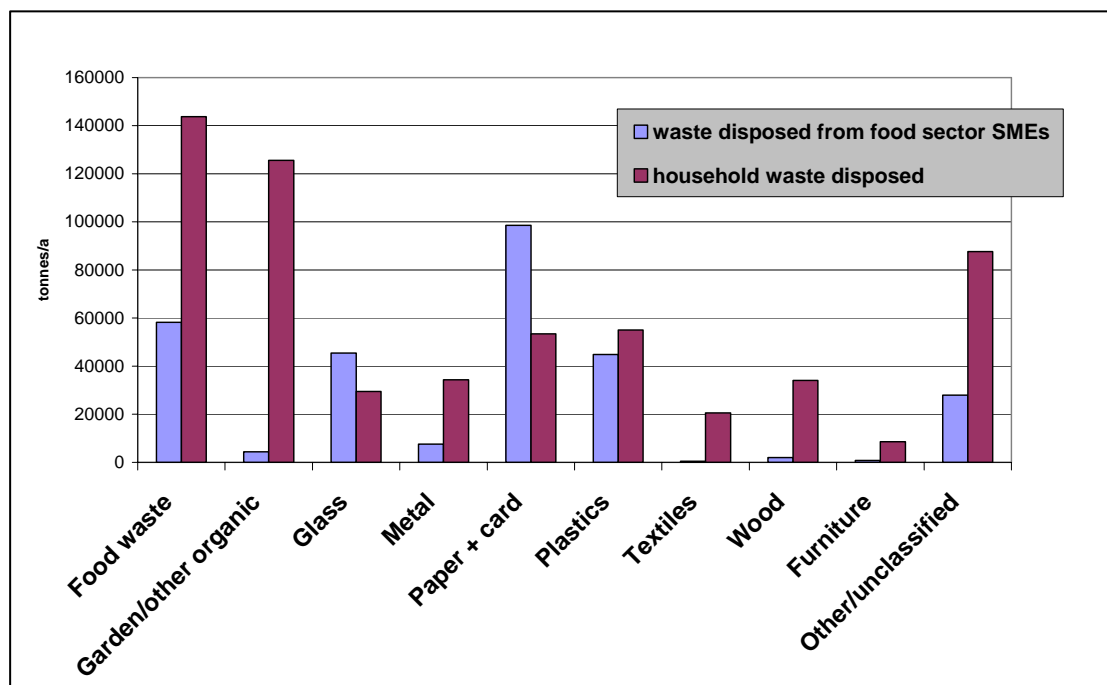
**Figure 8.7: Estimated comparison of resources in household waste and waste from food sector SMEs in Hampshire**

The current recycling rate overall for Hampshire is estimated at 33.5% (Defra, 2007). From detailed data on the amounts of material recycled in Hampshire by all the authorities in Project Integra (HCC, 2007) and this research comparison can be drawn between resources in waste from households and from food-related sector SMEs both those currently recycled and those disposed. These results are shown in Figures 8.8 and 8.9 below.



**Figure 8.8: Comparison of estimated amounts of resources currently recycled from wastes from food sector SMEs and households in Hampshire**

As Figure 8.8 shows, current recycling activity is dominated by paper and card in both sectors, followed by garden green wastes collected from households in Hampshire. The only material where greater quantities are recycled from food sector SMEs than households are plastics.



**Figure 8.9: Comparison of estimated amounts of resources currently disposed in wastes from food sector SMEs and households in Hampshire**

Figure 8.9 shows the amount of waste currently disposed of, and provides an indication of possible additional amounts of each resource potentially available for recycling, to give a comparison of the potential in both sectors for additional recycling activity. This is not to imply that all the material currently disposed of could be recycled – far from it as much will be contaminated or prove impractical to separate effectively – however it does show where resources are concentrated. In addition what potential exists for co-collection or processing will depend though not only on the amounts of material available but also a range of logistical, operational and financial factors. The resources which appear to offer most potential from this analysis for a combined approach to recycling for wastes from households and smaller businesses are food waste, paper & card, glass and plastics.

## **9. Applicability of methodology to large institutions and organisations**

The methodology described above was developed with SMEs specifically in mind. It does, however, have the potential to be used to carry out waste audits on other types of businesses, including large-scale institutions/public bodies such as local authorities, hospitals and universities.

Large organisations can potentially be disaggregated into a number of component parts, as they generally consists of multiple departments each carrying out different functions, and in some cases with multiple sub-units such as schools, homes for the elderly, libraries, etc., under their control.

The concept behind this idea is that such a body can be subdivided on the basis of cost centres or departments into a series of linked SMEs, each with its own management, targets and responsibilities. Many of these units will behave similarly to SMEs and face the same problems in effective management and disposal of their waste, with the difference that it is easier for them to seek group solutions. However, ideally, waste management and resource recovery needs to be targeted at this level, with a bottom-up approach forcing change at a higher institutional level where services to departments are provided. This can only be brought about, however, if the needs and outputs of the smaller units can be identified and quantified in an appropriate manner.

The strategy with regard to the use of the waste questionnaire to audit large organisations depends to a certain extent on the type of organisation and its structure. For instance:

- does the organisation have multiple departments/business types?
- does it have multiple locations?
- are the departments/businesses relatively autonomous? That is, are they relatively self-managing

For all types of large organisations it would probably be necessary to use a top-down (i.e. upper management) approach in order to gather information about the organisation; in particular, the structure of the organisation and the number of different departments/units. Each department can then be classified according to their activity and size, in terms of number of employees. If possible, the department can be allocated an appropriate SIC code that represents/matches the activity of the department. For instance, a primary school operated by a County Council would have the SIC code 80.10 ('Primary education'); whilst a finance department of an organisation may be allocated a SIC code of 74.12 ('Accounting, book-keeping and auditing activities; tax consultancy'). Similarly, the departments/units would be classified into an appropriate size band according to the SME definition of micro (<10 staff), small (<50), and medium (<250) sized businesses (or >250, if necessary).

This information can then be used to build a "business profile" for the organisation, consisting of a matrix of departments/units grouped by type of activity and size band. The business profile can then be used in order to determine the auditing requirements for the organisation; that is, the (minimum) number of departments/units within each matrix cell that have to be sampled in order to produce statistically representative data for the large organisation as a whole. This can be achieved through use of a similar methodology to that used for the audit of SME businesses described in Chapter 4.

After the business profile has been determined, the approach taken with regard to carrying out the waste audit would depend on the nature of the large organisation. The suggested approaches are:

- bottom-up (i.e. individual departments/units) for a large local government organisation such as Hampshire County Council (HCC)
- top-down, or a combination of top-down and bottom-up for organisations such as universities and hospitals

Details are given below of the structure of these two types of organisations, and the possible audit methodology for each.

### **9.1. Hampshire County Council (example of large local government organisation)**

The nature of the County Council means that it can be considered to be relatively autonomous, with a large number of departments/units that are essentially self-managing and located throughout Hampshire; for example, residential care homes and schools. Indeed, some waste management contracts and information may be dealt with by individual units.

The County Council is divided into various departments that carry out different functions/activities:

- Chief Executive
  - Economic Development, Emergency Planning, Press Office, Corporate Communications Team and Information Centres, and Policy Unit
- Environment
  - including Travel and Transport and Environment and Planning
- Finance (County Treasurer)
- Education
- Fire & Rescue
- Human Resources
  - including Equalities, Hampshire Learning Centre, Health and Safety and Job Vacancies
- IT Services
- Property, Business and Regulatory
  - Including HM Coroner, Property Management, Registration Service, Trading Standards
- Recreation & Heritage
  - including Archives, Arts, Countryside, Community, Outdoor Activities, Libraries & Information, Museums and Sport
- Social Services
  - Including Adult Services (social care for adults) and Children's Services

Some of the departments are relatively small and generally centrally located, consisting of the corporate activities, in particular the Chief Executive and Finance departments. Other departments will have corporate/divisional offices located centrally and may also have satellite offices located throughout the county. As well as having numerous offices, various departments consist of separate units that are also located throughout the County; for example, the education department encompasses all schools within Hampshire that come under County Council control. Information from HCC (Green-Wilkinson, 2004) indicates

that there are more than 1100 buildings either owned or leased by the County Council (Table 9.1 – owned buildings only): each building may be considered as an individual department or unit, although some may contain more than one; for example, the County Council headquarters.

Division	no. of buildings	Description
Education	644	mainly schools, some youth clubs, etc.
Estates	121	Farms (mainly tenant), various other activities, particularly the corporate/divisional offices for the different departments
Fire	57	no longer under HCC control
Libraries	53	Libraries operated by HCC
Magistrates	11	Magistrates and law courts
Museums	22	Museums operated by HCC
Recreation & heritage	46	includes community and arts centres, parks, etc.
Social services	99	includes residential care and children's homes
Surveyors	20	includes highways unit (depots, etc.)
Other	53	mainly Property, Business and Regulatory Services (offices)

**Table 9.1: Breakdown of buildings owned by HCC**

It can be seen from Table 9.1 that the majority of units within the County Council are within the education department; these are mainly schools and youth clubs operated by HCC. Other major activities associated with HCC include the provision of residential care and children's homes, libraries, recreational and heritage facilities, and fire stations (although no longer under direct control of HCC). In addition, the County owns a number of tenanted farms although, again, these do not come under the direct control of HCC.

Most of the units detailed in Table 9.1 can be considered to be autonomous, with day-to-day operation of them being managed by themselves. Hence, they can be considered similar in nature to SME businesses. It is only really the County Council headquarters that may be considered to be less autonomous, as it is an amalgam of various departments housed in one large building, with use of shared waste management facilities.

Therefore, a 'business profile' can be generated, either grouped by appropriate SIC code or type of activity, e.g. schools, youth clubs, education department offices (administration, etc.), and the sampling requirements determined. As well as staff numbers, in order to determine the appropriate size band, additional information that may be useful can also be gathered; for example, role count of pupils for schools, number of visitors to museums, libraries, etc., as this may have an impact on the waste arisings of departments/units with similar numbers of staff.

The waste questionnaire can then be used to audit the required number of departments/units within the sampling matrix. However, modifications will need to be made to parts of the questionnaire; apart from the SIC code section, this modification is really only to the peripheral sections of the questionnaire. The main changes are identified below:

- the SIC code section (determination of business activity) would need to be modified and expanded to include all possible SIC codes. There would also need to be an ability to match the activity of a department/unit with an appropriate SIC

code, either directly or indirectly, in terms of the typical types of waste generated by the department/unit; for example, an administration department would produce waste typical of any office-based business, e.g. accountants, lawyers, etc.

- re-wording of the section on business premises to make it more relevant to a large organisation, particularly a public body (i.e. remove references to business premises, and refer to building/site, etc.)
- “*your staff*” section – include here questions, where appropriate, about pupil role count, etc.
- changes to the types of waste crossed-out (i.e. unlikely to be produced), and description of typical types of material found within each waste category/sub-category. The waste questionnaire links this to the business activity (SIC code), so this section could be changed accordingly to link it to the activity of the department/unit

It would also be important to try and identify the most appropriate person to interview; i.e. the individual with the most knowledge about waste arisings and waste management practices of the department/unit. For example, the caretaker of a school may be more knowledgeable than the headmaster/headmistress.

From the waste audit, as with that for the food/food-related SMEs, an estimate of the total waste arisings for the organisation can then be made, based on the business profile.

## 9.2. University of Southampton

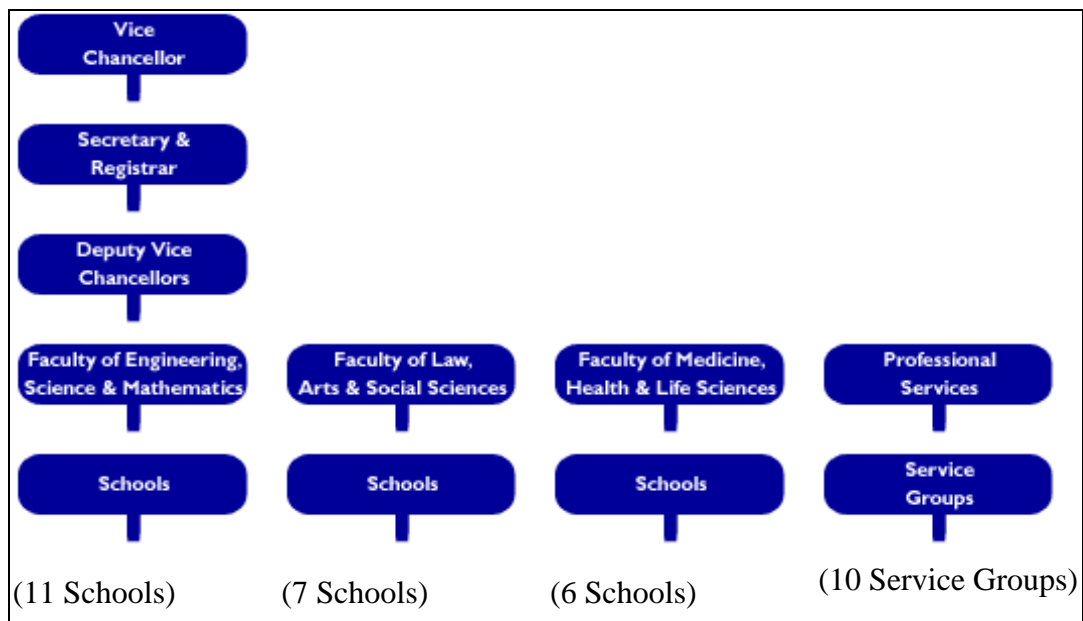
Unlike a large local government organisation, the departments/units of a university are generally more centralised, typically being located on one main campus; although larger universities, such as Southampton, may also have smaller satellite campuses. In addition, they generally have halls of residences (student accommodation) that may be located both on or off campus.

Figure 9.1 shows the management structure of the University of Southampton, which can be considered as a large, multi-departmental business. The Vice Chancellor is the Chief Executive of the business, whilst the ‘Secretary & Registrar’ is the senior administrator of the University (equivalent of a Company Secretary). There are then three Deputy Vice-Chancellors (DVCs), with responsibilities across all three faculties and Professional Services: the DVC concerned with Education, Recruitment & Marketing; DVC concerned with Research, Human Resources, Quality Assurance, Strategic Performance Review; and, DVC concerned with Financial Resources, Strategic Planning, Health & Safety, Enterprise & Innovation.

Each of the three faculties is headed by a Dean, whilst Professional Services are headed by the ‘Secretary & Registrar’. The Faculties are divided into a number of Schools as shown in the Figure, which may be split into several departments that, themselves, may be located in different areas of the campus; whilst ‘Professional Services’ is divided into a number of ‘Service Groups’, which includes departments such as ‘Estates & Facilities’, ‘Finance’, ‘Human Resources’, ‘Student Services’, etc., that provide a wide range of services throughout the University.

Management of the University on a day-to-day basis is undertaken by the University Executive Group, which is made up of the Vice Chancellor, Secretary & Registrar, the three DVCs and the three Deans.





**Figure 9.1: Management structure of University of Southampton**

(source: University of Southampton, 2006a)

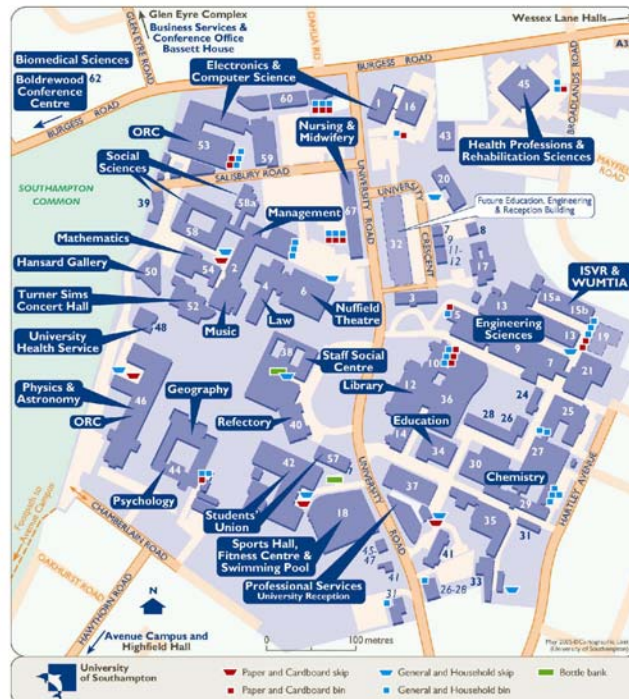
Various services also operate within the main and satellite campuses; for example, catering services (restaurants, cafés), sports facilities (including a swimming pool), shop, theatre, and, as mentioned before, halls of residences (located off-campus).

Therefore, an organisation such as a University has many departments/units; some may be considered as autonomous (e.g. halls of residence), whilst others are somewhat autonomous (shop, catering facilities). Most of these are ancillary services, which are generally more autonomous with regard to waste generation. That is, their waste facilities are not shared with other departments/units. This may be due to location (e.g. halls of residences off-campus), or the nature of the department/unit, e.g. restaurants/cafés that generate food waste containing meat or meat-based products that should ideally be disposed of separately from general waste.

Conversely, most of the other buildings on campus may be occupied by more than one School; or a School may be located in more than one building. Therefore, it is unlikely that each School would be able to identify the amounts and types of waste that they generate. This is particularly true if waste facilities are shared between Schools; depending on the size/closeness of buildings, waste from more than one building may be deposited in shared waste receptacles. It would thus, be difficult to determine the amount/type of waste produced, especially for office-type waste since this is collected by cleaners from offices, bagged-up, and deposited in communal waste containers servicing one or more buildings.

Similarly, containers used for recyclables (generally only paper and cardboard, and scrap metals) will also service several buildings. Indeed, these will be less common, so will each be used by more buildings. This is also compounded by the fact that there is not a formal infrastructure for the recycling of such materials, and it is therefore necessary for staff members to voluntarily take recyclables themselves to recycling points situated at various locations throughout the different campuses of the University. Figure 9.2 shows the location of the various facilities at the main campus.

For hazardous waste and waste electrical/electronic (WEEE) materials there may be a more structured management due to the nature of the materials and, thus, the need for greater control and recording of information relating to generation and disposal of these materials.



**Figure 9.2: Location map of waste facilities for Highfield Campus, University of Southampton**

(source: University of Southampton, 2006b)

As well as individual departments/units sharing facilities, making it difficult to apportion waste generation to each, they also have little control over waste management contracts, etc. These would generally be controlled centrally by the Estates & Facilities department of the University, and it is here that information regarding the waste management infrastructure and waste generation would be held. Therefore, the questionnaire could only be used in its present format if there was a change in strategy first: whilst waste management contracts would still be controlled centrally, individual departments/units would, where possible, keep their own waste records. However, in order to do this, and to estimate the waste generated by each department/unit, it would be preferable for them to have separate facilities, unless they are able to estimate how much the fullness of the containers can be attributed to them. The use of separate facilities would, in particular, be useful for monitoring the levels of waste generation, enabling the targeting of those departments/units that are generating high levels of waste. With shared facilities this would be difficult as there is no incentive/need for the individual departments/units to know the amounts and types of waste that they generate.

The questionnaire could then be used to audit selected departments (according to the business profile and sampling requirements identified above). It might also be worthwhile using the questionnaire to interview the person in charge of the cleaning service in order to determine the amounts (and, if possible composition) of the waste collected from offices, etc. by the cleaning staff. Additionally, it would also be necessary to identify any departments/units, not identified by the business profile, which might produce non-standard wastes; for example, the School of Chemistry might be classed primarily the same as other Schools within the University, but would dispose of chemicals in addition to typical general waste. These departments/units would then also need to be audited in order to identify these additional wastes. Alternatively, it might be possible to use the questionnaire in order to interview the University's waste manager for this purpose, as more detailed records would be kept for such wastes.

In order to identify how best to audit the University (or any other similar large organisation) it would be necessary to add a separate section to the questionnaire in order to determine the structure of the organisation and its waste management infrastructure. This section could also serve to identify who to survey within the organisation at the departmental/unit level. The questionnaire would also need to be adapted so that it is split into separate sections that can be completed independently of each other and, if necessary, at different times.

Hence, the first part of the questionnaire could be completed by the waste manager and/or another appropriate (corporate) manager in order to ascertain details of the University (number of employees, structure of the University – identification of the different departments/units, etc.), disposal options, number of containers, frequency of collection, etc. The aim here would be that the containers (whether shared or otherwise) would be assigned to the appropriate departments/units.

The remainder of the questionnaire could then be completed by the appropriate person in each of the departments/units audited. At the start of this section of the questionnaire, the interviewee would select their department/unit from a list generated in the section described above; and the questionnaire would then automatically be populated with the appropriate container(s), frequency of collection, etc. The interviewee would then only need to give details of how full the containers are, or (if shared) what contribution they make to the fullness of the containers; and the composition of what goes into them. This process would then be repeated for each department/unit to be audited. If more than one department/unit uses a container, then it would also be necessary to collate the information gathered from each, and compare the results obtained. This would be important in order to make sure that the individual volumes of waste going into a container, which are given by each department/unit, does not give rise to a total volume significantly greater than the volume of the container.

When the audit of the required sample of each department/unit has been completed, the results can then be scaled-up, based on the business profile, for the University as a whole. This could then also be compared with results that could be obtained from auditing the University as a single unit, through interviewing the waste manager to gather information about the total waste arisings and waste composition. This would most likely be an estimate based on the number of bin lifts and average fullness; it would be interesting to see how the results obtained by each method compare. Indeed, it would be helpful to validate the results obtained for both against a University-wide physical waste sampling exercise.

## **10. Interpretation and conclusions**

The resource potential from the waste stream of SMEs in the food manufacturing, wholesale and retail and hospitality sectors is clearly significant. The survey in Hampshire found that only 38% was currently recycled, of which almost three quarters is paper and cardboard, with the rest split fairly equally between glass, 'organics' (food and plant material) and plastic, plus a small amount of wood. This indicates considerable opportunity for increasing recovery of the main material constituents, particularly paper and card, food waste, plastic and glass. WRAP has recognised this potential in the hospitality sector through its support of trials to improve the recycling infrastructure. Other initiatives, including the EA's development of sector plans with food and drink manufacturers and Yorkshire Forward's Food and Drink Waste Scoping Study (Enviros, 2004), are taking place, but much more needs to be done.

The questionnaire design enabled more detailed information to be collected on all the wastes disposed, reused and recycled by the SMEs surveyed. This was particularly the case for those wastes dealt with by options other than the main local authority or waste management company contractor and which accounted for more than 20 % of total waste arisings. These are wastes or potential resources that might be missed by more conventional questionnaire designs, and in fact the average waste/employee or waste/business was in many cases found to be higher in the survey than values in the EA 1999 national survey. This was probably due to the emphasis placed in the questionnaire on capturing all waste and recyclable material including that sent by other routes which may not have been explicitly captured in what the businesses classed as waste in the EA survey. This is clearly indicated for the non-specialist retail group where this survey recorded significant amounts of waste recycled through 'backfill' where material was sent back to a central depot. The average waste /business without the backfill element more closely matched to the values recorded in the EA survey. This emphasis on capturing information about all wastes generated by a business enables a more accurate picture to be established of current recycling activity as well as future potential.

Although the accuracy of compositional data collected depended much on the knowledge and understanding of the waste stream of the interviewee, the nature and depth of the questioning did provide detailed categorisation of the main resource types in the C&I waste stream from this sector. Only 6% of the waste stream was unclassified, compared with the EA 2002/3 survey where general or mixed waste were the largest overall of the 8 compositional categories recorded, accounting for 32% of industrial waste, and 51% of commercial. A snapshot analysis sampling and weighing the waste from 24 of the surveyed companies showed a strong correlation between the composition recorded in the survey and that measured.

The survey estimated the total waste arisings for food manufacturing, food wholesale and retail and the hospitality sectors for Hampshire at just over 465,000 tonnes per year, although this could be somewhere between 330,000 and 600,000 tonnes pa due to the relatively high degree of variability of the survey data.

Non-specialist retail (supermarkets and convenience stores) produce the greatest quantity of waste, with most arising from small and medium sized businesses. Restaurants and bars also produce significant quantities of waste with most produced by the micro and small businesses which account for 98% of the businesses in these sectors.

Paper and card are the most sizeable resource element at nearly half the waste stream (48%); 'organic' waste, predominantly food waste, is the next largest at 17%, followed by glass and plastics at 13%. Food manufacturing has the highest proportion of organic waste per business of all the sectors, as might be expected as much of its production waste would be food by-products; and all of the 'organic' waste from this sector is food waste. The hospitality sector produces more glass waste than any other, especially from pubs and bars (44%), and reasonably high proportion of 'organic' waste, particularly from restaurants.

The overall contribution from micro and small businesses with fewer than 50 employees (which account for 95% of food-related businesses in Hampshire) was 61% of the total waste. Medium sized companies which only account for 5% of the total number of businesses produced 39% of the total waste arisings. The average recycling activity found amongst medium sized businesses surveyed was often more than double that on average found amongst the micro or small businesses. Recycling activity varied between sectors with retail and manufacturing having the highest recycling rates. Non-specialist retail has a high overall recycling rate of 61% and even higher rate for paper and card mainly board packaging – 81%. Food manufacturing is the most effective sector at recycling its food waste with over 90% recycled, with most of this being taken away by other businesses. This sector also produces a lot of paper and card – mostly packaging material – nearly half of which is recycled.

Recycling activity is low for the hospitality sector with restaurants and bars performing worst with overall recycling rates of 10% and 17% respectively. Glass was the material most likely to be recycled by this sector, with hotels recycling 64%, restaurants 19% and bars 26% of their glass waste, predominantly bottles. Just under half of the glass recycled by the hospitality sector was at recycling banks, and was even more significant for pubs and bars where this proportion was over 70%.

The survey shows similarities in the resources available for greater recovery from small businesses and those in the household or municipal solid waste stream. The estimated total waste from food sector SMEs in Hampshire is just over half the amount of household waste collected in the county. Paper and cardboard, glass and plastics, much of it packaging materials and food waste are all significant components of disposed waste from both SMEs and households and offer from this analysis most potential for combined collection and/or recycling. This is not to imply that all the material currently disposed of could be recycled – far from it as much will be contaminated or prove impractical to separate effectively – however it does show where resources are concentrated. In addition what potential exists for co-collection or processing will depend though not only on the amounts of material available but also a range of logistical, operational and financial factors.

These results however, although demonstrating the potential of the methodology, are based on a relatively small survey sample and for a limited range of business types. The food sector SMEs surveyed only account for about 13% of all SMEs in Hampshire. In order to fully explore the potential for increasing resource recovery from the SME sector further research is needed to improve data on waste arisings and composition for other SIC code groups, as well as larger surveys of the food sector to improve statistical accuracy of the results. Additional research might also focus specifically on different waste streams, such as SME food wastes for example, to explore the most resource efficient or sustainable options for dealing with these wastes. Not only is data lacking on what the resource potential is, but more analysis is needed to understand how these materials might best be captured and treated, such as whether by separate collections or recovery from mixed wastes.

The methodology was designed to demonstrate the approach and the potential for wider applicability. The next stage of this research, currently funded by Defra as part of the Waste

and Resources R&D Programme, is developing the existing 'smart questionnaire' into a web-based tool with potential for assessing the wastes from any SME business type (Thomas et al, 2006). This tool has been designed to be adapted for use in other areas/regions by agencies requiring information on SME wastes, including local or regional authorities, the EA or other bodies.

The results of this research provide information that could help develop infrastructure for increased recycling from this sector, as well as opportunities for exploring combined collection and processing with household wastes. One such example is the current use of the data to support the development of the Environment Agency's Hampshire Food and Drink Pilot project. This is designed to pilot integration of C&I and municipal food & drink biodegradable waste collection, and promotion of resource efficiency & waste prevention; inter-organisational/ regulatory collaboration to promote regulatory compliance in SMEs in the food and drink sector; and the SMEtoolkit developed by the EA to support effective influencing of SMEs and particularly smaller businesses.

The waste strategy review in England suggests that improving linkages across different waste streams is one way to improve the access of affordable recycling and recovery services for smaller businesses (Defra, 2006). It refers to potential benefits from economies of scale and the potential improved affordability of aggregating demand. Local authorities already collect around 10% of waste generated by SMEs from small businesses such as shops, small trading estates, council offices and local parks and gardens; they are also considered the most likely source of guidance on environmental issues and in securing recycling services from the smallest businesses (EA, 2005). Comments from many of the small businesses participating in the survey indicate a willingness to recycle but frustration with lack of suitable facilities; and that more provision from local authorities would be welcomed by them. Some local authorities are pioneering the way through initiatives such as the development of the Material Resources Strategy in Hampshire (HCC, 2005), and the waste strategy review (Defra, 2006) has now clearly placed this issue on the agenda.

The methodology for auditing wastes from SMEs developed in this project has proved able to provide reasonably detailed data on the resource potential of SME wastes. In addition, in future developments, this data could be used to generate a resource map of C&I waste resources which could be used in planning infrastructure needs, in identifying opportunities for new businesses to develop using the resources reclaimed from waste, and in mapping the way forward for the sustainable management of C&I waste in the UK.

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